PUBLISHED EVERY SATURDAY
AT NO. 9 MURRAY STREET, NEW YORK.
Telephone Call: Murray 586. Cable Address: "Electrical," New York.
Western Office, 23 Borden Block, Chicago.

W. J. JOHNSTON, Editor and Publisher.
T. COMMERFORD MARTIN, JOSEPH WETZLER, Associate Editors.
E. P. THOMPSON, Associate Editor Patent Department.
CLARENCE E. STUMP, Business Manager.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.00.
(Postage Prepaid in the U. S. or Canada.)
CLUBS.—In clubs of 4 or more, $2.50 a year each, with a free extra copy to the getter-up of a club of 8. Subscription to foreign countries $4 a year.
In requesting your address changed, give old as well as new address.

THE ELECTRICAL WORLD
HAS THE LARGEST CIRCULATION
OF ANY ELECTRICAL JOURNAL PUBLISHED, AND IS
THE BEST ADVERTISING MEDIUM.
Advertising Rates are much lower than those of any other similar publication, circulation and standing considered, and vary according to space, position and number of insertions.
Notices of Situations or Help Wanted, $1 to $3 an issue.

Correspondence, views and opinions on all topics within the province of this journal are cordially invited from any part of the world. We will thank readers to forward to us—**promptly** as they occur—**Items of News**, or information relating to any application of electricity, also marked copies of their local papers containing anything likely to interest electricians. Anonymous communications cannot be noticed, nor can rejected manuscript be returned, unless accompanied by the necessary postage when received.

Matter for the **Editorial** Department should be addressed to
The Editor of The Electrical World, New York.
Subscriptions and communications relating to **Advertising** or the **Business Department** should be addressed simply,
THE ELECTRICAL WORLD, New York,
Or, when more convenient, they can be sent to the Chicago office.

CONTENTS.

ILLUSTRATED ARTICLES: PAGE.
Electric Transmission of Energy—II. ... 172
Portable Electric Light Plant 173
The Brush Incandescent Machine ... 173
The Fithian Engine ... 174
Electric Laryngoscope and Otoscope ... 175
The Chloris Baudet "Impolarizable Battery" ... 178
EDITORIAL PARAGRAPHS ... 171
MISCELLANEOUS:
Another Underground Conduit ... 173
An Electric Steering Gear ... 174
An Analytical and Systematic Method of Inventing. (*Continued.*) ... 174
MISCELLANEOUS: PAGE.
Incandescent Lamp Tests at Philadelphia ... 175
The Cost of Lighting New York Streets ... 175
Investigating the Telephone Business ... 176
The Lay of the Telegraph Pole ... 178
Telegraphic Physiology ... 178
DEPARTMENTS:
Western Notes ... 179
The Telegraph ... 179
The Telephone ... 179
The Electric Light ... 180
Applications of Power ... 180
Stock Quotations ... 180
Business Notices ... 180
Our Illustrated Record of Electrical Patents ... 180

New Advertisements.

A. A. Marks—Artificial Limbs. ... iii
C. E. Jones & Bro.—Telegraph and Electrical Supplies ... v
J. W. C.—Address Wanted ... v
E. W. Hazazer—Electric Bells ... v
W. R. Pope & Co.—Electric Bell Outfits ... v
Detroit Electrical Works—Pins and Brackets ... v
Grand Rapids Electric Light and Power Co.—Arc Lamps ... v
REARRANGED ADVERTISEMENTS.
Stout, Meadowcroft & Co.—Electric Lamps ... i
New York Safety Steam Power Co.—Engines ... i
Leclanché Battery Co.—Disque Battery ... ii
Callender Insulating and Waterproofing Co.—Insulated Cables ... iv
Electrical Supply Co.—Callender Insulated Cables ... v

Vol. V. NEW YORK, MAY 2, 1885. No. 18.

Handsomely bound volumes of THE ELECTRICAL WORLD *for* 1884 *are now ready, and will be sent, charges prepaid, to any address on receipt of* $5.00.

AN illustrated article appearing in our columns to-day, shows how admirably the electric light has been adapted to the most exacting requirements of the physician, surgeon and dentist.

A CONSIDERABLE portion of our space in this issue is devoted to the report of the investigation of the telephone interests in New England, now being made by a committee of the Massachusetts Legislature. The evidence of Messrs. Forbes, Ingham, Glidden and others will be read with a good deal of interest.

THERE appears to be no manner of doubt as to the success of the Electrical Exhibition at Paris, under the auspices of the International Society of Electricians. Although there are few novelties, one exhibit is described as attracting great attention—the Gérard incandescent lamps, of a power up to 800 or 1,000 candles, and of a remarkable efficiency.

AFTER all, the certainty that England will have cheap telegrams this year is not so very great. It is said that there is every probability that an amendment to the Telegraphs Bill will be offered, in favor of free address, as against the proposed system of charging for every word, to which we referred editorially last week. Should the amendment be adopted the bill must be abandoned. As the bill involves a loss of revenue, it is unreasonable to suppose that the government would object just now to the killing of it.

THE recent fluctuations in the provision market have done more to break up the "bucket shops" than all the efforts of the exchanges, and from all parts of the country have come reports of the losses they have sustained and of their failure. But it will not do to be very sanguine as to their permanent suspension. They will soon find a new lot of fools for customers. It is significant of the extent to which this gambling business is carried on that one of the New York bucket shops that went under had no fewer than 67 branch offices throughout the country.

A SUIT to foreclose its mortgage of $10,000,000, held on the Bankers & Merchants' Telegraph Company, has been brought by the Farmers' Loan and Trust Company in this city. It is alleged that the concern is thoroughly insolvent, and that nothing can save it. This collapse is, in truth, one of the most remarkable of the time, and would have been the subject of much livelier interest if it had not been eclipsed by other failures at the time of the panic. The price of the stock last April was about 120; to-day it is nominally quoted at from 2 to 3. And yet the company was seriously regarded by many as the most formidable rival that the Western Union Company would have to deal with in coming years.

THE Commercial Cable Company has displayed the most praiseworthy enterprise throughout, making plain its resolve to spare no expense for good work and a complete system. It has now been engaged for some days in putting underground its wires from down town up to Harlem, and thence out to Westchester, connecting with the lines already up. But while the work is being done neatly and expeditiously, it is absurd for the *Herald* or any other paper to take it as a text and preach sermons from it to the other electrical companies in New York. To put these land lines underground is comparatively easy, causing no interruption to traffic in the down town streets, but it would be an undertaking of a very different character to put all the electric systems, all over the city, underground at one and the same time.

THE retirement of Mr. Cyrus W. Field, after half a century of public life, will be a source of regret to many in the electrical world. Commencing as a clerk for Stewart at a dollar a week, he has earned his place as a millionaire. Twenty years after his humble start we saw the Atlantic Cable finished, owing principally to his untiring energy and perseverance, and the City Hall in this city proclaiming in hundreds of gas-jets, "Honor to Cyrus Field." Later, as national recognition, came a gold medal from and the unanimous thanks of Congress, and then the knighthood, which he virtually declined, and which Captain Sir James Anderson, of the "Great Eastern," received from Queen Victoria. Relieved now of the personal cares and responsibilities which have weighed so long upon him, Mr. Field may live a long and honorable life in private. Mr. Field should rank in the history of the telegraph with Professor Morse, Amos Kendall and William Orton.

WITHIN the last month or two, cable items of the following nature have cropped up quite frequently in the papers: "The telegraph line between Meshed and Teheran is broken. Sir Peter Lumsden is thus prevented from communicating direct with London." It is not unreasonable to suppose that Russia or some of her friends in Persia could explain why these breakages occur so opportunely. This month, too, a cable dispatch from Spain stated that the wires had been cut between Madrid and Saragossa, by persons unknown, and that in consequence rumors had been afloat as to a military outbreak in the north of Spain. The rumors were declared to be without foundation, but had the rising taken place, the interruption of telegraphic communication would have greatly helped the insurgents. The fate of Spain was perhaps at stake, just as the fate of two great empires now hangs on the thin wire running through Persia to the heart of Central Asia.

WE publish to-day a statement laid before the aldermen of this city, purporting to show the relative cost of lighting New York with gas and the electric light. The endeavor is made to prove that the total excess of the cost of 2,740 arc lamps for the streets would be at least half a million dollars more than that of gas lamps for the same area. As a reply to this, the electric light companies can point to the vastly superior illumination of the thoroughfares in which their lamps burn, and can refer to the opinion of the police authorities that every new arc lamp is equivalent to an additional member of the police force. Besides, the people want the electric light, and know only too well that it will not do to leave the gas companies without competition. The greater the use of electric lights, the lower the price of both electricity and gas will fall. European capitals envy New York its liberal display of arc lamps.

THE generous action of the Central & South American Cable Company and the Western Union Telegraph Company in transmitting, on Sunday last, April 26, all family and social messages of officers of the United States military and naval forces between Panama and their homes, was evidently appreciated by the officers in question as a great convenience, and by the people here as a public-spirited piece of business. The only regret is that both companies did not extend their courtesy to the Jack Tars as well as the officers. Of course, as the latter naturally availed themselves of the opportunity, and sent over 200 deadhead messages, they monopolized the cable for one day, but the companies might choose a "Sailors' Day,' and see how gladly the Blue Jacket would telegraph home to his Black-eyed Susan to say he was well and just dying for a fight. Meantime the thanks of the public are due to the Cable Company and the Western Union for their liberality.

IF General Barrios, late President of Guatemala, had issued ten years earlier his famous "Union Decree," of Feb. 28, 1885, when there were no telegraphs to speak of within a thousand miles of Central America, he would certainly, with his cool calculation and reckless, bold spirit, have carried all before him and become Military Dictator of Central America. But the telegraph frustrated his plans. The "Union Decree" was flashed instantly to all the world, and Barrios, knowing that, felt it to be better policy to wait and see what the world said—by telegraph. The famous "Menacing Dispatch" came at once from President Diaz, of Mexico; and then General Bogran, of Honduras, dissented—by telegraph; and finally Barrios found his Brutus—by telegraph—in Zaldivar, of Salvador. Deserted thus on all sides, nothing was heard of or from him until his corpse was dragged from the battle-field. The telegraph balked his plans, and therein lies the lesson. The battles of New Orleans, fought in 1815 although the treaty of peace was signed at Ghent in December, 1814, and of Toulouse, fought while the couriers were galloping south with the news of the peace negotiations already signed, only add to the story of how life may be saved and empires preserved by the telegraph. Another passing example of the utility of the telegraph is the spectacle of W. H. Lennox Maxwell, the murderer of Arthur H. Preller, at St. Louis, slumbering in fancied security on the high seas between San Francisco and Australia, while his record as Maxwell, D'Auquier and Brooks is being published here far and wide, and the police wait with open arms to receive him as the tempest-tossed steamer comes into port.

ABOUT fifteen months ago the electric light was installed in the Prince's Theatre, London, the plant consisting of a Clerk gas-engine, a Siemens dynamo, fifty-seven 4 horse-power Faure-Sellon-Volckmar accumulators and three hundred and seven 16 candle-power Swan lamps. During the first year, now reported upon, the engine was run 2,985 hours, and the lamps burned for 1,340 hours. The total working cost for the year was about $2,200. As to the result, Mr. Edgar Bruce, the proprietor, says: "I can certify to the most satisfactory working of the electric light at the Prince's Theatre during the past twelve months. It has never failed on any one occasion, owing to the working from accumulators, instead of direct driving, and the light is thereby rendered perfectly steady." This is a most satisfactory experiment, and ought to inspire confidence anew in the availability of secondary batteries. Mr. E. L. Berry, the electrician in charge, says that in the first six months not one of the accumulators was touched. During the last half of the year, eighteen required attention, eight of them being repacked with new positive plates. He describes the general condition and result as follows: "Among the positive plates (positive-pole plates) taken out, a great many were found to have lost as much as from 35 to 40 per cent. of the paste out of them, while the negative plates (negative-pole plates) showed no signs of depreciation whatever. After twelve months' work the boxes showed no signs of leaking, and were all in very good condition. Each box contains 29 positive and 30 negative plates with gun-metal connections. They are coupled up in series, and there are 49 or 50 in circuit during the time the lights are on, the rest standing by as a reserve. The dynamo, as a rule, is run during discharge of the boxes, though the boxes have stood discharge without the machine, for supplying the whole of the lights, during the performances on five different occasions." With respect to the lamps it is interesting to note that they were used everywhere. It goes without saying that the light was highly appreciated by the patrons of the theatre, and that the tasteful, delicate ornamentation of all parts of the stage and auditorium remains untarnished.

Electric Transmission of Energy.—II.

BY W. M. SCHLESINGER, ELECTRICAL AND MECHANICAL ENGINEER.

In the last article the following formulas governing transmission of power by means of electricity were found:

I. $W = HJ + w$.

II. $C_1 = \frac{E-e}{R}$; $C = \frac{E}{R}$.

III. $E\,C_1 = e\,C_1 + R\,C_1^2$; $W = E\,C_1$.

IV. $w = e\,C_1$.

And for maximum work:

$$w = \frac{E}{2}C_1\ ;\ e = \frac{1}{2}E;\ C_1 = \frac{1}{2}C.$$

As was pointed out before, and as these formulas show, not all the work put into the generator will be recovered through the motor. In the following I will still assume both generator and motor to be perfect—that is, transforming energy of one form into another without loss. Of course, in practice this will not be the case, but the nature and amount of such losses are known to all good dynamo-makers, who, therefore, also know by what means they can be brought down to the lowest limit. Moreover, it would be very difficult, if not even quite impossible, to give formulas covering all these sources of loss. But experience has given us empirical formulas and numbers, which I will take into account at the proper place. But, aside from these losses, part of the energy is lost in the circuit, being that part which is necessary to force the current through this circuit. The rest of the energy will appear as useful work in the motor (assumed to be perfect). Now, the efficiency of any system is the ratio of the useful work to that spent in producing it; that is, if η stand for the efficiency of transmission,

$$\eta = \frac{w}{W}, \text{ and in our case}$$

$$\eta = \frac{w}{W} = \frac{e\,C_1}{E\,C_1}; \text{ that is,}$$

$$\eta = \frac{e}{E}. \qquad \text{V.}$$

According to this equation, the efficiency of transmission is as the ratio of the electromotive forces. This again shows that Jacobi's law of maximum activity has nothing to do with the efficiency. The counter electromotive force e can range between the limits $e = 0$ and $e = E$, at the same time will range between $\eta = 0$ and $\eta = 1$. If $e = 0$, then $\eta = 0$ too; if $e = \frac{1}{2}E$, then $\eta = \frac{1}{2}$; if $e = E$, then $\eta = 1$. In the first case, the motor will be doing no work, as the energy put into the generator will be lost in heating the wires of the circuit. With e the efficiency will gradually rise, and at the same time the actual work got out of the motor in unit time, till $e = \frac{E}{2}$, at this point $\eta = \frac{1}{2}$; that is, half the energy put into the generator is lost as heat in the circuit; the other half appears as useful work, and for $e = \frac{E}{2}$ too, the motor will be doing most work. As e continues to rise, η does the same, but at the same time the work done per unit time sinks again, till $e = E$. Now, $\eta = 1$, but the motor will be doing no work, and theoretically the generator ought to require none either; but in practice this is impossible, as e can never rise so

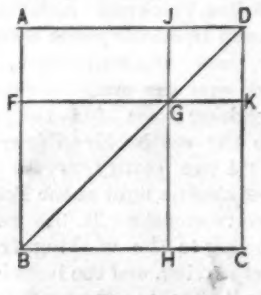


FIG. 4.

high that $e = E$. The cause of this is the resistance of the circuit, and, of course, the mechanical resistance of the armature, such as friction, etc. In practice, it is difficult to measure the counter electromotive force e (e must not be confounded with the difference of potential at the terminals of the motor); it is more convenient to measure the current flowing through the circuit and the difference of potential at the terminals of the generator, and, knowing the resistance of the generator and the other part of the circuit, the electromotive force of the generator is easily found, and equation II. will give the counter electromotive force.

These relations between counter electromotive force, efficiency and work per unit time can very easily be shown graphically with the diagram used by Thompson. Let $A\,B$ (Fig. 3) again be equal to E, $F\,B = e$, and the lines $F\,K$ $J\,H$ drawn as before; then, R being constant:

$$A\,F\,K\,D = E\,(E-e) = W$$

$$G\,H\,C\,K = e\,(E-e) = w.$$

The efficiency of transmission will then be as the ratio of these rectangles, and the work lost in heating the circuit will be represented by $J\,G\,K\,D$, as $A\,F\,J\,G$ is equal to $G\,H\,C\,K$.

This diagram therefore represents a case in which either the load put on the motor is too large or the armature not properly geared to the rest of the working parts (in an electric locomotive, to the wheels). The result is that the armature of the motor cannot move with the necessary speed, and therefore the counter electromotive force is very low. Fig. 4 is the diagram of another case; $A\,B$ again is equal to E, $B\,F = e$. The work spent in the generator is, therefore, again represented by the rectangle $A\,F\,D\,K$, and the useful work by $G\,H\,C\,K$. It is easy to see that in this case the efficiency represented by the ratio of the two rectangles is far superior to that represented by Fig. 3. Whereas in Fig. 3 $F\,B$ is $\frac{1}{5}$ of $A\,B$ (*i. e.*, $E = 3e$), and in consequence rectangle $G\,H\,C\,K$ is one-third of $A\,F\,K\,D$, the efficiency being therefore $\eta = \frac{1}{3}$, in Fig. 4 $F\,B$ is two-thirds of $A\,B$ (that is, $2\,E = 3e$), and, therefore, rectangle $G\,H\,C\,K$ is $\frac{2}{3}$ of rectangle $A\,F\,K\,D$, making the efficiency $\eta = \frac{2}{3}$. In this case, therefore, although only *half the work* has been put into the generator, the motor is doing *exactly the same amount* of work as in the case represented by Fig. 3.

In the expression for the efficiency

$$\eta = \frac{e}{E},$$

there is no term representing the resistance R. This proves

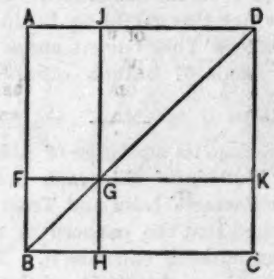


FIG. 3.

clearly that theoretically there is no limit for this system of transmission, and that the resistance of the circuit, or, what amounts to the same thing, the distance between the two stations, may be ever so large, so long as $\frac{e}{E}$ is kept constant, the efficiency will always be the same. In practice, of course, a limit exists, because if we make R larger, keeping E and (in order to have the same efficiency) e constant, a smaller current would flow through the circuit, as will be seen by referring to equation II.

This equation may be written

$$C_1\,R = E - e;$$

E and e being the same, $E - e$ is constant; altering R, therefore, will also alter C_1. The result is, that $E\,C_1$ would be smaller than before, and, consequently, if the resistance is made larger the electromotive forces will also have to be increased.

Again, if we keep the resistance constant, but alter the electromotive forces, keeping $E - e$ constant, then, according to equation II. the current C_1 will be constant too. In equation III. the term $R\,C_1^2$ represents the amount of energy lost as heat in the circuit, and as it only involves R and C_1, it follows that if these remain the same, the former will not vary with the varying electromotive forces. But, on the other hand, making E and e larger also makes the amount of energy transmitted and the amount transformed into useful work larger. Diagram 5 shows this graphically.

On comparing it with Fig. 4, it will be found that $J\,G\,K\,D$, representing the heat wasted, is the same in both cases, but the rectangles $A\,F\,K\,D$ and $HG\,K\,C$ are larger in Fig. 5 than in Fig. 4. More energy has therefore been transmitted; but as the losses are the same, the efficiency in the case represented by Fig. 5 is larger than in that represented by Fig. 4. The amount of energy, therefore, that can be transmitted over a circuit having a given resistance is again theoretically without limit, and the larger the amount of energy transmitted the larger will be the efficiency of transmission, if $E - e$ is kept constant.

Let E, for example, be 200 V., $e = 150$ V., and $R = 10$ ohms;

then $E - e = 50$

and $C_1 = \frac{200-150}{10} = 5$ ampères.

The amount of energy put into the generator is

$$W = E\,C_1 = 1000 \text{ watts};$$

the useful work is

$$w = e\,C_1 = 750 \text{ watts};$$

energy lost as heat,

$$HJ = R\,C_1^2 = 250 \text{ watts};$$

the efficiency is

$$\eta = \frac{e}{E} = \frac{150}{200} = \frac{3}{4}.$$

Now let

$E = 400$ V., $e = 350$ V., and R again 10 ohms;

then

$$E - e = 50.$$

$$C_1 = \frac{400-350}{10} = 5 \text{ A.}$$

$$W = E\,C_1 = 2000 \text{ watts.}$$

$$w = e\,C_1 = 1750 \text{ watts.}$$

$$HJ = R\,C_1^2 = 250 \text{ watts}$$

and

$$\eta = \frac{e}{E} = \frac{350}{400} = \frac{7}{8}.$$

We have now put into the generator double the amount of energy; of this the same amount is lost in heating the circuit, and the efficiency has risen from $\frac{1}{2}$ to $\frac{7}{8}$.

This clearly shows that it is always more economical to use small currents with high electromotive forces, the more so as the higher the electromotive force the larger the resistance can be made without altering the efficiency, and therefore the less will be the cost of the circuit. But in practice the electromotive force cannot well be made higher than 3,000 V., the highest limit, I think, used in this country. Of course, so high an electromotive force would not do for every case; if the circuit can be run on insulators high enough to be out of reach of passengers, as the electric light leads are, 3,000 V. might be used; but with electric railroads the case is different, for although the conductors can be so placed or insulated as not to endanger life, or *even give the slightest shock* to those crossing the track, yet the leakage from one lead to the other would be too large. What electromotive force is best for any particular case must be decided by the engineer, as it depends to a great extent on the system he intends to use.

Sir William Thomson has given a formula for computing the most economical section of conductor, which may in some cases be used with advantage, although it is not adapted to all cases; but here again it must be left to the engineer to decide when to use or how to modify the formula.

The resistance of any circuit may be expressed by the formula,

$$R = \frac{l}{s}r,$$

l representing the length of the conductor, s its cross-section, and r being the specific resistance of the metal used—that is, the resistance of a bar 1 metre long, and having a cross-section 1 square millimetre.

The loss of energy through heat, expressed in M. Klgr. S. units is

$$HJ = \frac{C^2\,R}{9.81} = \frac{C^2\,l\,r}{s\,9.81},$$

or for unit length (1 metre),

$$HJ = \frac{C^2\,r}{s\,9.81}.$$

Now there are 31.5×10^6 seconds a year, but the current is only used part of this time—that is, for $31.5 \times 10^6 \times p$ seconds only (where $0 < p < 1$).

The amount of energy, therefore, lost in one year is:

$$A = \frac{31.5 \times 10^6 \times p\,C^2\,r}{9.81\,s}.$$

Let P stand for the cost of one horse-power per year, then the cost of one unit of work S. Klgr. M. system) will be

$$\frac{P}{31.5 \times 10^6 \times 75},$$

and the cost of A. units—that is, of the amount of energy lost in a conductor 1 m. long and with s square mm. cross-section will be

$$L = \frac{P\,p\,C^2\,r}{9.81 \times 75 \times s}.$$

Now, if interest on investment capital be taken at c per cent. a year, and the cost of one cubic metre of the material be v, then the cost of a conductor one metre in length and s square mm. cross-section will be

$$L^1 = s\,v\,10^{-6}\,c.$$

The total is: $$L + L^1 = \frac{P\,p\,C^2\,r}{9.81 \times 75 \times s} + v\,10^{-6}\,c\,s.$$

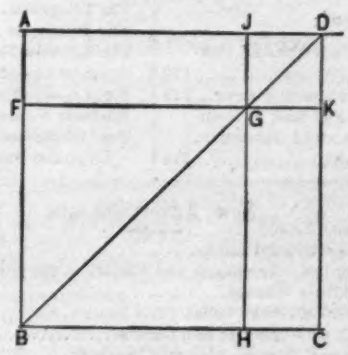


FIG. 5.

This will be a minimum if L is equal to L^1—that is,

$$\frac{P\,p\,C^2\,r}{9.81 \times 75 \times s} = v\,10^{-6}\,c\,s;$$

from which equation we get

$$s = \sqrt{\frac{P\,p\,C^2\,r}{9.81 \times 75 \times 10^{-6} \times v\,c}} = C\sqrt{\frac{P\,p\,r\,10^6}{9.81 \times 75 \times v\,c}}$$

or if $c = 5$,

$$s = 162.56\,C\sqrt{\frac{P\,r\,p}{v}}.$$

Up to the present we have assumed that only that amount of energy is lost which appears as heat in the circuit; but there is another source of loss due to the leakage of current between the two conductors. With currents of low tension this is not perceptible, as the insulation can easily be made perfect; but on long lines and with high electromotive forces this loss may be so large as to lower the efficiency somewhat.

It will now be necessary to say a few words about the resistance and efficiency of the different parts of the circuit. The circuit consists of three different parts, and they are: the generator, the conductors, and the motor. Letting r_1 stand for the resistance of the generator, r_2 for that of the conductors, and r_3 for that of the motor, then the resistance of the circuit will be:

$$R = r_1 + r_2 + r_3.$$

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

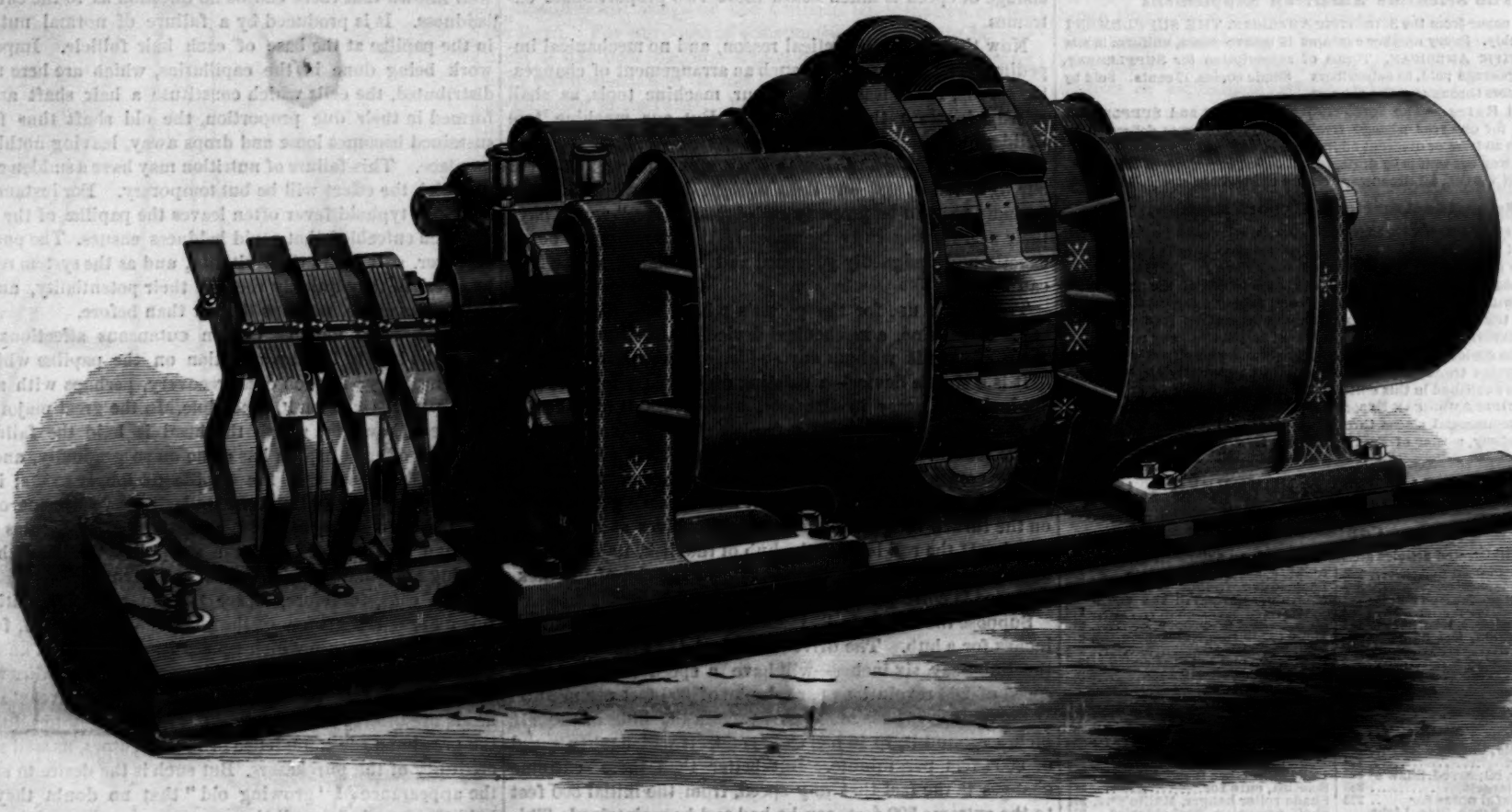
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LI.—No. 18. [NEW SERIES.] NEW YORK, NOVEMBER 1, 1884. [$3.20 per Annum. [POSTAGE PREPAID.]

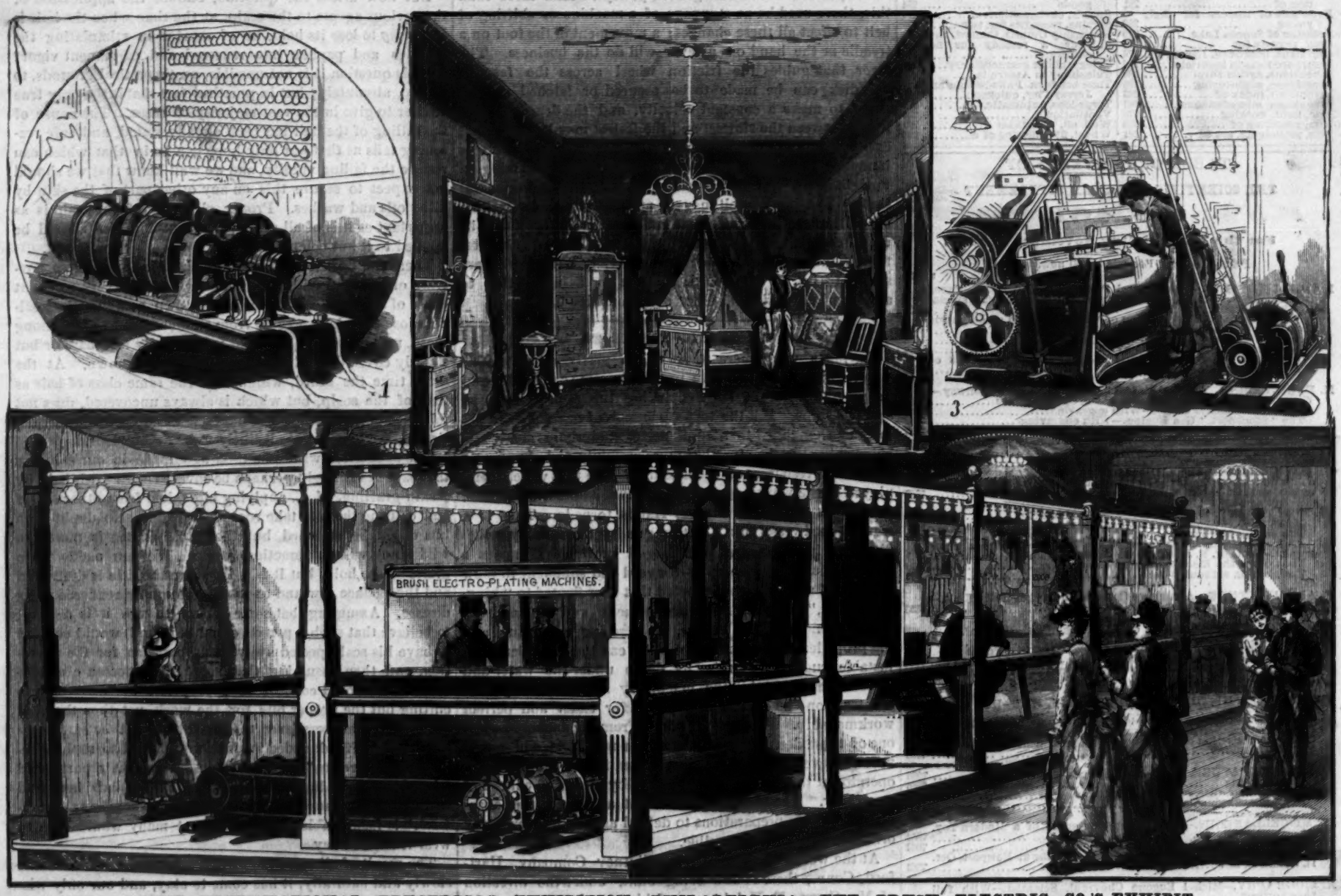
THE EXHIBIT OF THE BRUSH ELECTRIC COMPANY AT THE INTERNATIONAL ELECTRICAL EXPOSITION PHILADELPHIA.

To the intelligent visitor, as well as to the student, the Brush exhibit was a constant source of attraction. So extensive was the plant, and so varied its features, that new and interesting subjects for contemplation were constantly appearing. Scattered through the great hall around pillar and buttress were myriads of lamps, large and small, bearing the legend, "Brush system." But to understand their character, a mere glance would not suffice; the large lamps differed in important essentials from those of any other system displayed, and the small incandescence lights, though giving out the same intensity, were of altogether different

(*Continued on page* 277.)



THE BRUSH DYNAMO ELECTRIC MACHINE.



THE INTERNATIONAL ELECTRICAL EXHIBITION, PHILADELPHIA.—THE BRUSH ELECTRIC CO.'S EXHIBIT.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included..... $3 20
One copy, six months postage included..... 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 361 Broadway, corner of Franklin street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year postage free, on receipt of *seven dollars*. Both papers to one address or different addresses as desired.

The safest way to remit is by draft, postal order, or registered letter. Address MUNN & CO., 361 Broadway, corner of Franklin street, New York.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information: (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 361 Broadway, corner of Franklin street, New York

NEW YORK, SATURDAY, NOVEMBER 1, 1884.

Contents.

(Illustrated articles are marked with an asterisk.)

Aerial navigation..... 273
Bacteria, atmospheric*..... 279
Baldness.—Its prevention and its removal..... 272
Balloon ascension, nocturnal..... 280
Blue to collodion, the addition of..... 280
Boiler, efficiency of a..... 282
Boiler, low pressure*..... 274
Box, change, street car driver's*. 275
Bronze, cobalt..... 277
Business and personal..... 283
Catamaran, steam*..... 278
Crane, coal, improved*..... 275
Crane, movable, Cardiff docks*... 275
Chucking wax..... 274
Colter hanger, improved, Shaw's* 275
Dredger, the largest..... 280
Engineers, useful notes for..... 273
Exhibit of the Brush Elec. Light Co. at Interna. Elec. Exhib.* 271
Fires, forest, cause and prevention of..... 281
Foresight of insects for their young..... 280
Freezing of Seneca Lake..... 279
Gout, remedy for..... 274
Gun sight, improved, Lyman's*.. 276
Insurance risks in inebriety..... 282
Inventions, agricultural..... 283
Inventions, engineering..... 283
Inventions, index of..... 283
Inventions, miscellaneous..... 283
Iron, hard, working..... 276
Iron, upsetting of..... 273
Life, prolonging, art of..... 281
Light, electric, at Hell Gate..... 282
Locomotive, freight, 12 wheel*.. 278
Man, old, smartest in the country..... 273
Man, weight of, proper..... 279
Meta exhibition, Nuremberg, 1885 278
Nail, ingrowing..... 275
New books and publications..... 283
Notes and queries..... 283
Organisms, living, of the atmosphere*..... 279
Panacea for trouble..... 277
Paris, the real..... 280
Patent Office, delays in..... 282
Planets, aspect of for November. 273
Pond lilies, domestic..... 282
Pulleys, leather faced..... 275
Sciatica, cure for..... 281
Shade roller hanger, Mullin's*... 274
Shell, explosive, Bachelder's*... 274
Shortsightedness..... 274
Solder, poisonous, in canned goods..... 274
Speeds, changeable..... 272
Sprains, remedies for, two..... 276
Steamship Umbria, Cunard, new. 279
Sulphur a remedy for hog cholera..... 275
Telegraphing extraordinary..... 277
Telephony in Australia..... 275
Time between Philadelphia and Jersey City, quickest..... 281
Torpedoes, automatic..... 272
Ventilation..... 274
Weil oil, a gigantic..... 280
Wheel, fly, bursting of a..... 276

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 461,

For the Week ending November 1, 1884.

Price 10 cents. For sale by all newsdealers.

PAGE

I. CHEMISTRY, ETC.—The General Progress of Chemistry.—Paper read by Sir H. E. ROSCOE at the meeting of the British Association in Montreal..... 7352
Apparatus for the Congelation of Water by Means of Sulphuric Acid.—1 engraving..... 7354
Against Wrought Iron for Water Pipes..... 7354
Determination of Nitric Acid by M. ARNAUD..... 7354
Distillation under Atmospheric Pressure.—Different forms of distilling apparatus.—3 figures..... 7355

II. ENGINEERING AND MECHANICS.—The Superga Railway.—With full description of the mechanism, operation, etc..... 7356
Improved Masonry Crane.—With engraving..... 7357
The "Stockport" Gas Engine.—With engraving..... 7357
A New Tachometer.—3 figures..... 7358
Military Transportation by Railroad.—Ordinary and strategic transportation..... 7358

III. TECHNOLOGY.—The Heat-conducting Power of Materials.—On a new method of measuring heat-conducting power of various materials, such as cotton, wool, hair, etc.—2 figures and tables..... 7360

IV. ELECTRICITY, ETC.—An Electrical Actinometer..... 7360
Hall's Effect.—Experiment with gold leaf and a galvanometer.... 7360
The Earth's Magnetism..... 7360
An Extraordinary Experiment in Synchronous-Multiplex Telegraphy.—By Prof. E. J. HOUSTON.—With diagram..... 7361
The Cost of the Electric Light in France..... 7362
Telephoning without Wires..... 7362

V. ARCHITECTURE.—A Summer Cottage, Tunbridge Wells, Kent.—An engraving..... 7356

VI. GEOLOGY, ETC.—Thinolite of Lake Lahontan.—By Prof. E. S. DANA..... 7363
Gravitation Survey of the United States.—By C. S. PEIRCE..... 7363
Some Results of the Exploration of the Deep Sea, beneath the Gulf Stream by the U. S. Fish Commission Steamer Albatross.—By A. E. VERRILL..... 7364

VII. NATURAL HISTORY, ANTHROPOLOGY, ETC.—How should a Horse be Shod?..... 7355
On the Structure of the Brain of the Asellus and the Eyeless Form Cecidotæa.—By A. G. PACKARD..... 7363
On the Civilization of the Native Peoples of America.—By Prof. E. B. TYLOR..... 7363

VIII. HORTICULTURE, ETC.—The Catalpas.—3 engravings..... 7365
Transplanting..... 7366
Perennial Lobelias.—1 figure..... 7366
Dagame.—A valuable wood..... 7366

IX. MISCELLANEOUS.—An Ancient Counterpart of a Modern Toy.—2 engravings..... 7362
The Largest Organ in the World..... 7362
The National Academy of Sciences.—Meeting at Newport, Oct. 14, 15, and 16, 1884..... 7363

X. BIOGRAPHY.—Michel Eugene Chevreul, Scientist.—With full page portrait..... 7362

CHANGEABLE SPEEDS.

It is beyond question that our present method of changes of speed of lathes, drills, milling machines, planers, and other tools where changes of speeds are required is a crude one, and unworthy of present mechanical capability. At the best, our changes are made by moving the belt from a large driving pulley to a smaller driven pulley, or from a small driving pulley to a larger driven pulley. But each of these changes involves a positive and unalterable degree of change of speed. It must be "Hobbs or nothing." A graded pulley may range thus in diameters: 6 inches, 8 inches, 10 inches, 12 inches. Suppose the spindle speed is 200 revolutions per minute, the small delivering pulley would give 300 feet per minute, the next 400 feet, the next 500 feet, and the last 600 feet. Between these changes of 100 feet per minute there are no intermediate speeds. It must be a change of 100 feet per minute. This is a favorable estimate of the changes of graded pulleys; it is seldom the grades are so near or that they range in the proportion stated—6 inches to 12 inches. Generally the total range of change of speed is much below these two proportionate extremes.

Now there is no theoretical reason, and no mechanical impediment, or hinderance, to such an arrangement of changeable speeds, for at least some of our machine tools, as shall greatly increase their usefulness. But our machine tool builders appear to run in ruts—shop ruts—and are slow to adopt a new thing and slow to adapt an old thing. Some of our light lathes and our light upright drills, which are fed by hand so as to be properly called "sensitive," would have their usefulness greatly increased if the speed could be as exactly and designedly governed and regulated as the feed can be.

There is in use for the potter's wheel, and also for the sewing machine, a mechanical device that will give a long range of speeds without any sudden and abrupt changes.

It is a simple device—a rotating disk twenty-four, thirty-six inches or larger in diameter, and across it from center to periphery extends a shaft feathered (with fixed key) the entire length. On this shaft traverses a sliding roll or small pulley controlled by a forked guide attached to a lever moved by hand or foot. The roll has a bearing by spring on the turned face of the disk, which revolves at a constant speed. If the roll is near the hub of the disk, its speed may not be fast; but if it is guided too near the rim of the disk, its speed is correspondingly increased.

Suppose the disk to be 36 inches in diameter, and allow four inches for a hub. The driven wheel at the nearest point to the hub—say six inches—will have a speed (at the initial speed of 200 revolutions per minute) of 300 feet per minute. If the driven wheel comes away from the hub, or the six inches around it, to 16 inches beyond, it will have a speed of 800 feet per minute. But better than these extreme changes is the fact that *any* speed, from the initial 300 feet to the extreme 800 feet, can be had and be maintained. This is not possible with exact graded pulleys. And more than this, there need be no stoppage of a machine or shifting of belt to effect all these changes; a movement of the foot on a treadle or the hand on a lever will do the business. The lever that guides the friction wheel across the face of the disk can be made to be secured or latched at any point to make a constant velocity, and the degree of velocity between the slowest and the fastest may be controlled exactly. The position of the driving disk and its shaft is immaterial. I have seen it on a horizontal shaft driving an upright shaft, and on a vertical shaft driving a horizontal shaft. The friction roll may be made of disks of raw hide or of leather, or be of hard rubber—the latter not to be used in oil, but is unaffected by water. There is no question of the utility of this device as already used, and there seems to be no insuperable obstacle to its adaptation to small upright drills and other small machine tools.

AUTOMATIC TORPEDOES.

During a war, where it is waged partly on navigable waters, fixed torpedoes have proved, in some cases, effectual in preventing or at least delaying the approach of an enemy's ships. But the torpedo branch of naval service has long ago extended to the offensive, and there is no machinery in existence that has more certainly and abundantly proved the resources of the machinist than that which is employed in the working of the offensive automatic torpedo. As an illustration take the Lay-Haight torpedo. This is a cigar-shaped vessel thirty feet long and perhaps thirty inches diameter in its central and largest portion. It carries a charge of an explosive in its forward end sufficient to blow the largest and strongest ironclad that ever floated to "kingdom come." In the after compartment and all amidship are the generator, the engine, the steering apparatus, and the propeller shaft, and at the outer end the propeller. Adjustable rudders determine its depth under the water and direct its course. All the machinery is of the very best construction; no expense is spared for exact and perfect workmanship. From the shore, or from an anchored ship, one of these destroyers can be sent a mile, one and a half miles, or even two miles, being guided in its course by the operator at the fixed starting point, by means of wires and electricity. The torpedo can be sent at a speed that absolutely prevents preparations to defend against it, even if any ordinary defense was possible.

At the works of the Pratt & Whitney Company, Hartford, Conn., there is now being built, under the direction of Mr. George E. Haight, one of his torpedoes that is to be submitted to a foreign government for approval before the award of a contract for a number of these naval weapons. This one is being made of sheet copper instead of sheet steel, the material of which most of the Lay-Haight torpedoes has heretofore been made. The engines which are to drive the propeller are six in number, or rather the engine is a group of six cylinders working synchronously with a speed that will develop about 1,000 revolutions of the screw propeller per minute. It is calculated and confidently believed that the speed of this torpedo will be almost if not quite at the rate of twenty miles per hour at a depth below the surface or from thirty inches to forty-eight inches. A distance of two miles will be traversed in six minutes, giving little opportunity for the crew of a hostile vessel to take defensive measures, even if they could detect its starting and determine its approach. The motive power of the engines is carbonic acid gas.

BALDNESS.—ITS PREVENTION AND ITS REMOVAL.

The mode of formation and growth of the hair is now so well known that there can be no question as to the cause of baldness. It is produced by a failure of normal nutrition in the papillæ at the base of each hair follicle. Imperfect work being done in the capillaries, which are here richly distributed, the cells which constitute a hair shaft are not formed in their due proportion, the old shaft thus feebly sustained becomes loose and drops away, leaving nothing in its place. This failure of nutrition may have a sudden cause, of which the effect will be but temporary. For instance, an attack of typhoid fever often leaves the papillæ of the scalp so much enfeebled that rapid baldness ensues. The papillæ, however, still retain their vitality, and as the system regains its strength they quickly recover their potentiality, and the hair comes again, perhaps thicker than before.

In the same manner certain cutaneous affections may cause the hair to fall by an action on the papillæ which is but temporary; in such cases recovery, perhaps with assistance, perhaps without it, is possible. In the great majority of instances, however, where the head is bald the failure of nutrition of each papilla has come on so gradually, and has continued so long, that the papilla no longer exists; it has passed away by atrophy; its capillaries have become obliterated, and even the follicle itself no longer constitutes a depression in the cutis, and the scalp has the smooth and shining appearance which we so well recognize.

It is easy, therefore, to see that in such a condition as this no renewed growth of the hair is to be expected, for the anatomical structure which caused its development and continued it has ceased to exist, and the countless remedies which are so freely advertised as being able to rejuvenate bald heads are utterly of no avail. They serve only to illustrate the greed and the impudence of the inventors, as well as the credulity of the purchasers. But such is the desire to escape the appearance of "growing old" that no doubt they will hold their ground for all time to come.

But now arises the question, Cannot the application of the various agents to the scalp, at the time when the hair is *beginning* to lose its hold, be of service in stimulating the follicles and papillæ into renewed and permanent vigor? To this question it is not possible, on theoretical grounds, to say no, absolutely; but in practical fact that is the only true answer to give in the vast majority of cases. The cause of the falling of the hair has been already stated, and safe reasoning tells us that our only hope can be in that which can restore the failing vitality, and we well know that we should not expect to secure this on any other part of the skin by filthy oils and washes. Proper cleansing of the scalp is as important as it is of all other parts; nothing else should be applied to it but common sense.

There can be little question that the continued close covering of the head with hats and caps is one very constant cause of baldness. Women, in our own communities, seldom lose their hair, except from sudden causes; and among those nations where the head is habitually left bare or but slightly covered, baldness is practically unknown. At the same time the beard, which is of the same class of hair as that of the scalp, but which is always uncovered, does not fail with age. A reform in our style of head gear is very desirable, but it is not at all likely to be accomplished.

The suggestion was some time ago made in our columns that bald heads might perhaps be covered anew with hair by "skin grafting," *i. e.*, applying bits taken from other scalps and causing them to take root and spread. No doubt such bits might be attached, but the whole matter is merely a wild fancy without practical value. We can make "skin grafts" take hold, but it is only where the skin is destroyed and the surface raw and exposed, commonly rendered so by disease. Assuming that some person (though it is difficult to believe that such a person could be found) would consent to have his scalp peeled away in preparation for the operation, and then assuming that some other person could be found who would consent to appropriate his own scalp to cutting out the proper bits for the work, yet then the very best possible success (even theoretically) must be extremely imperfect. The denuded surface would heal so rapidly between the "grafts" that no extension on their part could take place, and a head with small specks of hair here and there would be the only attainable result. "Crazy patchwork" is fashionable, but perhaps not many would care to wear it in that way.

The result of all seems to be that when baldness has come slowly and naturally, it has come to stay, and our only wisdom is to be content.

Let l_1 l_2 l_3 stand for the losses of energy in these different parts, then we will have:

$$l_1 = C_1^2 r_1,$$
$$l_2 = C_1^2 r_2,$$
$$l_3 = C_1^2 r_3,$$

and the efficiency will be: $\eta = \eta_1 \times \eta_2 \times \eta_3$, and

$$\eta_1 = \frac{E C_1 - C_1^2 r_1}{E C_1} = \frac{E - C_1 r_1}{E};$$

$$\eta_2 = \frac{E C_1 - C_1^2 r_1 - C_1^2 r_2}{E C_1 - C_1^2 r_1} = \frac{E - C_1 r_1 - C_1 r_2}{E - C_1 r_1}$$

$$\eta_3 = \frac{E C_1 - C_1^2 r_1 - C_1^2 r_2 - C_1^2 r_3}{E C_1 - C_1^2 r_1 - C_1^2 r_2} = \frac{E - C_1 r_1 - C_1 r_2 - C_1 r_3}{E - C_1 r_1 - C_1 r_2}.$$

But $C_1 r_1$ is the electromotive force necessary to force a current C_1 through a resistance r_1; $E - C_1 r_1$ will therefore be the difference of potential at the terminals of the generator, and for similar reasons $E - C_1 r_1 - C_1 r_2$ will be that at the end of the conductors or terminals of the motor. On the other hand, $C_1 r_2$ gives the loss of electromotive force due to the resistance of the wire on the motor, but the electromotive force at this end of the circuit has already been shown to be equal to e, and if e_1 and e_2, respectively, stand for the other two, then we have:

$$\eta_1 = \frac{e_1}{E}, \quad \eta_2 = \frac{e_2}{e_1}, \quad \eta_3 = \frac{e}{e_2},$$

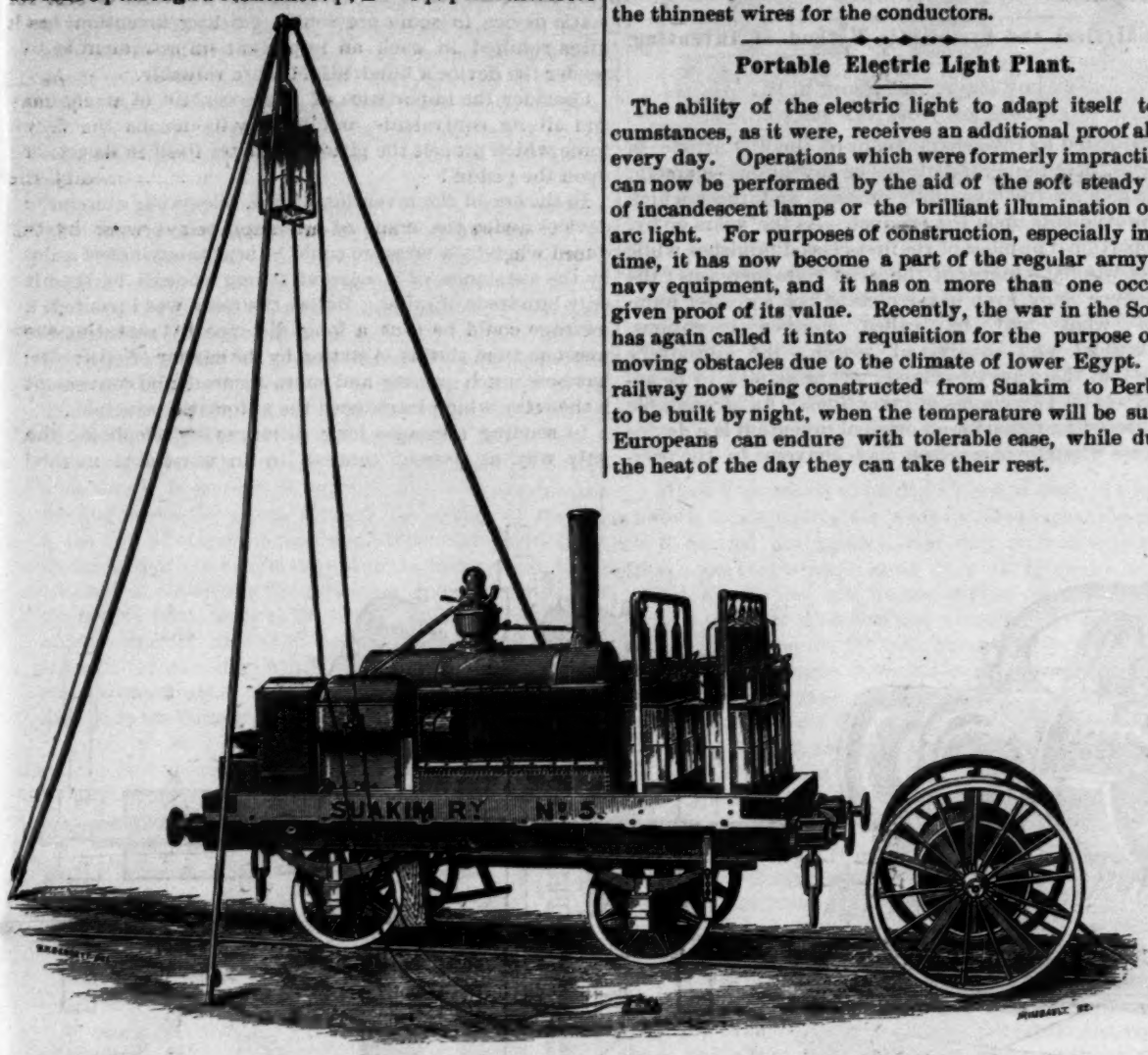
and

$$\eta = \frac{e_1}{E} \times \frac{e_2}{e_1} \times \frac{e}{e_2} = \frac{e}{E}.$$

Having now found the rules governing the efficiency, it will be well to say a few words about the value of η best adapted to practice. The commercial efficiency of a system transmitting power by means of electricity does not only depend on the efficiency of transmission, but also on the amount of capital necessary to construct the system. That plant will certainly be the best in every respect which, with the smallest capital required for construction, will allow the highest efficiency of transmission. It will therefore always be advisable, and with large plants (like a system of electric surface roads replacing horse cars) it will be a necessity first to take into consideration all available facilities, and to consider, above all, whether the cost of unit work is high enough to justify a high efficiency of transmission requiring a larger capital for construction; it requires also a consideration of the kind of insulation which can be used with the least cost, so as to allow the highest electromotive force, and from these considerations combined η is thus chosen and the whole plant designed accordingly. The disadvantage under which many existing plants labor is that this has not been done; they have been built for the greater part without any regard to theory, and the result is that many of them show a low efficiency.

Although it is impossible to give values for η covering all cases, certain limits can be given which will do for most ordinary purposes. As far as my experience goes, I would fix these limits at between 70 per cent. and 80 per cent. But for most purposes I have found that making $\eta = 75$ per cent. will give the best results; 80 per cent. can, of course, be obtained in practice, but unless the distance is small, or the cost of unit work very large as compared with the cost of material, I would not advise the adoption of so high an efficiency. On the other hand, where the distance over which power is to be transmitted and the cost of material are very large, whereas work can be produced comparatively cheaply, η may be made even as low as 50 per cent., as then most work will be got out of the whole plant. But η ought never to be made lower than 50 per cent. (N. B.—η stands for the efficiency of transmission.)

As the resistances of generator and motor have a great influence on the efficiency of the system, several rules have been given to determine them. One of these is to make the resistance of generator and motor together equal to the resistance of the rest of the circuit. The best rule, I think, is to make their resistances as low as is consistent with the required electromotive forces, as this will allow the thinnest wires for the conductors.



ELECTRIC LIGHT ON THE SUAKIM RAILWAY.

Portable Electric Light Plant.

The ability of the electric light to adapt itself to circumstances, as it were, receives an additional proof almost every day. Operations which were formerly impracticable can now be performed by the aid of the soft steady light of incandescent lamps or the brilliant illumination of the arc light. For purposes of construction, especially in war time, it has now become a part of the regular army and navy equipment, and it has on more than one occasion given proof of its value. Recently, the war in the Soudan has again called it into requisition for the purpose of removing obstacles due to the climate of lower Egypt. The railway now being constructed from Suakim to Berber is to be built by night, when the temperature will be such as Europeans can endure with tolerable ease, while during the heat of the day they can take their rest.

To carry out this arrangement there have already been supplied two complete installations for electric lighting, and as will be observed from our illustration, for which we are indebted to *Engineering*, the arrangement is very compact and well adapted to the requirements.

The engine, boiler and dynamo for each set, as well as the supports for the lamps when not in use, are all neatly fixed on a specially designed light railway truck. When in use the lamps will be hung from iron tripods 32 feet in height, and placed at intervals of 30 yards along the line of the proposed railway.

The tripods are made of light iron tubing jointed at the top and made telescopic in the middle, so that they can be folded together, removed and united wherever required with the least possible trouble. The insulated cable to convey the electric current to the lamps is coiled on reels, two being supplied with each installation. On these reels the cable can be run off or wound up as required. The lamps, which are of 2,000 candle-power each, can also be moved forward, one at a time, from one end to the other, as the work of construction proceeds, a simple switch arrangement being provided for the cutting off of the current from any particular lamp without interference with any of the others. The dynamo machines are of the Brush type and are driven by Parsons patent high-speed engines.

The boilers are of the locomotive type and are supplied by means of a feed pump with water from a tank fixed under the dynamo machine, which latter by this means is also kept cool during work. The carbons of the lamps are arranged to burn for a period of 16 hours.

Another Underground Conduit.

Our recent issues have contained descriptions of various underground conduits exhibited at Philadelphia, the diversity of which would seem to have well-nigh exhausted the field of invention. But we have to record still another recently exhibited in this city, which presents certain novelties and apparent advantages.

The conduit consists of a wooden trough 6 inches square, in which, at proper intervals, discs of fibre are placed. These discs are perforated, and through these perforations paper tubes are drawn, which are held in place at properly spaced intervals. In the experimental installation shown there were sixty-four tubes so placed.

The paper tubes being in position, the interstices between them and all parts of the trough are filled up with a composition of asphaltum, which, when hard, forms a solid mass, keeping the tubes rigidly in place and preventing the access of moisture.

The tubes as shown are about ¼ inch in diameter, and the wire is No. 12. This gives an ample air space surrounding the wire, and induction is provided against by winding the paper tubes with metal-covered tape.

A manhole was also shown, giving a good idea of the manner in which the wires of various companies would be placed without interfering with one another, and at the same time be easy of access. Quite an ingenious and simple device was shown in connection with this installation, for the purpose of getting the wires through the tubes. The wires are not drawn, but forced through. This is accomplished by passing them between two iron rollers covered with india rubber. By turning the rolls the wire is tightly gripped and forced forward, being led directly into the tube, where it has no chance to buckle, and it thus passes through to the next manhole.

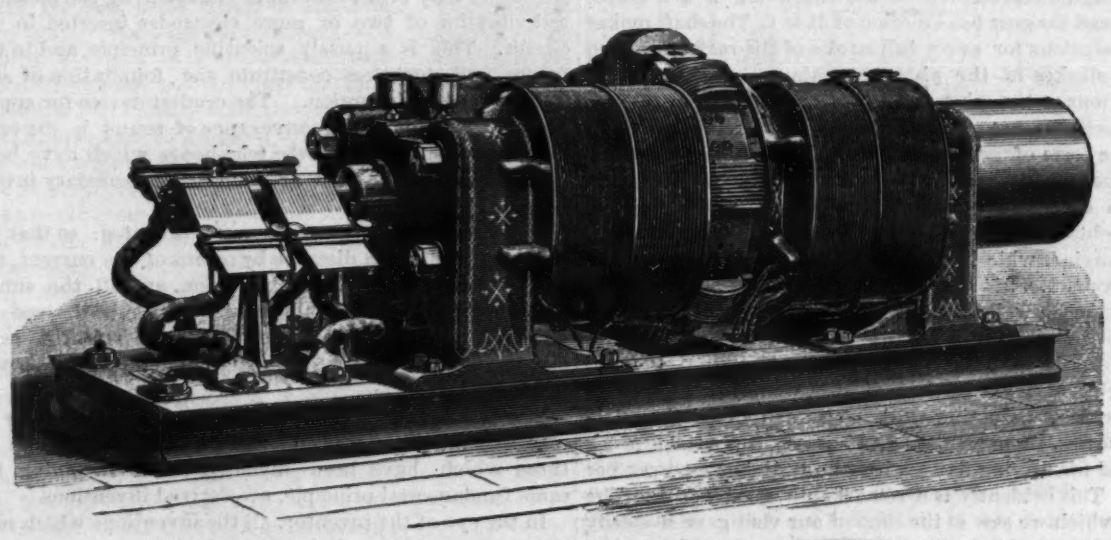
The invention appears to be quite practicable, and in the hands of competent men it may be developed into one of some importance. The system is operated by the Electric Underground Conduit Company, of this city.

The Brush Incandescent Machine.

With but one exception all the companies which entered into the electric lighting field in this country started out to manufacture machines and lamps for arc lighting alone. It soon became apparent, however, that the little incandescent lamp occupied quite as important a position as its brilliant brother, the arc, and hence, in order to meet the demand, the companies made efforts to provide incandescent light machines and lamps.

The incandescent type of machine of each company is generally of the same external pattern as the arc, as the Brush machine exemplifies notably. Our illustration shows the latest form adopted by the Brush company, and as will be seen it resembles their arc machines in external appearance. The details of construction differ, of course. The armature of the machine is of the improved "built-up" type lately introduced by Mr. Brush, and the field magnets are compound wound, as shown. This makes the machine entirely self-regulating, so that any number of lamps may be turned on or off without affecting the brilliancy of the remaining ones, the power required being proportionally changed. This results from the fact that the speed being constant the electromotive force remains constant, no matter what the resistance of the external circuit may be.

The lamps used in connection with this machine are of the Swan type, the 10 and 20 candle-power being principally used. A great many of these machines have already been put into operation, and the results are everywhere highly satisfactory.



BRUSH DYNAMO FOR INCANDESCENT LIGHTING.

The Fithian Engine.

Our attention has recently been drawn to an electric light installation in this city, the most characteristic part of which consists in the engine used to drive the dynamo. The object which it is sought to carry out in it is the attaining of a high velocity of rotation from a slow-moving piston, and without the use of numerous cumbersome countershafts with their necessary waste of power.

Our illustration, Fig. 1, shows a perspective view of the engine. The piston rod, as will be seen, is connected directly to a frame containing an upper and a lower rack, which transmits motion to the shaft by means of the pawls acting upon the pinion within it. This, consequently, obviates the necessity of a crank and allows the engine to be started and to exert its full power in any position of its stroke, since there is no dead-centre.

The motion so given to the shaft is transmitted to the multiplying gear, which is shown in detail in Fig. 2. The internal bevel-gear wheel *C* is fixed to the shaft and gives motion to the wheel *D*, which is fixed on the standards *F F*. The wheel *D* in its turn transmits motion to the wheel *G* at the beveled hub *b*. This wheel, as will be noted, is not fixed to the shaft, but revolves freely on a long sleeve bearing. The bevel-gear *I* is fixed to arm *H*, and gears respectively with *G* and the sleeve *K*, which is beveled at *c*. By tracing the arrows it will easily be seen that the final direction of *K* is the same as that of *C*, the primary wheel. The fly-wheel is attached to *K* and upon it also the gears are mounted for driving the dynamo.

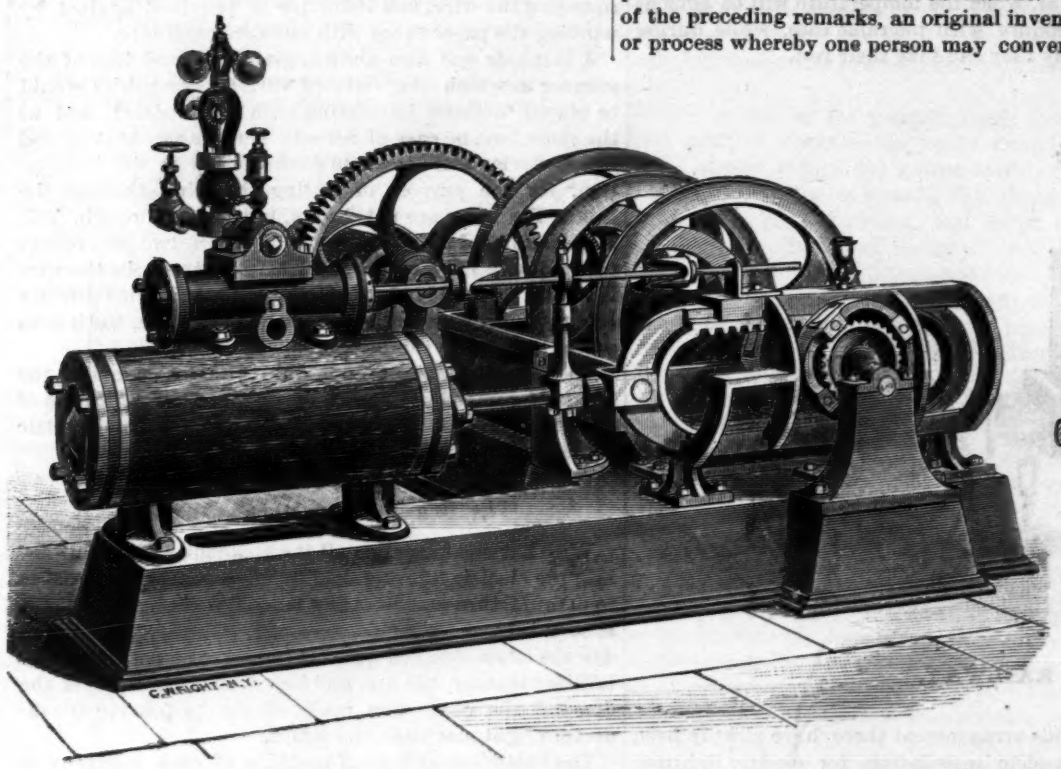


FIG. 1.

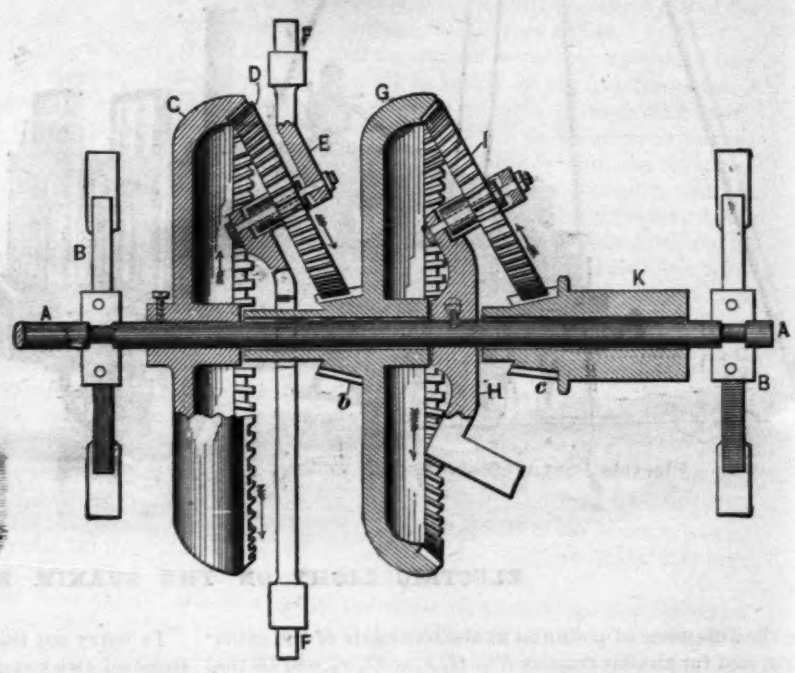


FIG. 2.

THE FITHIAN ENGINE.

The engine represented in the engraving is a 3 horse-power, and the gear has a motion of 31 to 1. The shaft makes 1¾ revolutions for every full stroke of the rack frame, so that 20 strokes of the piston per minute give over 1,000 revolutions at the other end.

The performance of this engine is quite remarkable; in fact, the form of gear adopted by Mr. Fithian increases the power, or, perhaps more correctly, reduces the loss, to such an extent as to make it appear doubtful whether the results obtained are correct.

The engine, which is now at work at the office of the company at No. 224 Centre street, this city, was recently indicated by a well-known engineer, the work of the engine consisting in driving a Maxim dynamo feeding five arc lamps of *nominal* 2,000 candle-power. The total work of the engine, as shown by the indicator, was 3.18 horse-power, from which, deducting work consumed in friction, 1.12 horse-power, there resulted 2.06 horse-power as the work required for driving five arc lights, or .41 horse-power per lamp. This evidently is a remarkably good result. The lamps which we saw at the time of our visit gave a steady light, fully equal in brilliancy to that of any which are to be seen on regular circuits.

Another test, made by an engineer whom we know to be accurate and reliable, showed equally good results; so that, to all seeming, little doubt remains as regards the reliability of the figures. The plant can be seen in operation every day at the above address, the officers of the company courting the fullest investigation.

An Electric Steering Gear.

A form of electric steering gear for guiding torpedoes in their progress towards the object of attack has been devised by Mr. Robert Scott, of Newcastle-on-Tyne, and it is claimed for the invention that by its use the action of the torpedo will be rendered absolutely certain at a distance of two or three miles; and this, too, even should the attacked and the attacker be vessels traveling in opposite directions. The steering gear is of course attached to the torpedo, and as it is propelled there is being paid off a fine insulated wire, by means of which electric communication is kept up between the torpedo and the ship from which it is projected. The rudder of the torpedo may thus be deflected in either direction by means of a current of electricity generated by a battery placed upon the vessel, this current at the same time acting upon an indicator under the eye of the operator, every movement of the torpedo being registered upon this indicator, which thus makes known to those who are conducting the operations its exact locality and progress. The steering gear itself weighs about 10 pounds, and the whole arrangement, with magnets and batteries complete, about 22 pounds.

An Analytical and Systematic Method of Inventing.

BY EDWARD P. THOMPSON, M. E.

(*Continued from page* 126.)

As intimated by the general tenor of the first article in this series, there two grand classes of inventions—namely, those which are fundamentally original, and those which are improvements upon the original. As the years go by, the proportional number of the first-class diminishes while the proportional number of the latter class increases; the consequence being, even in the present age, a greater number of what may be called derived inventions. By a critical and analytical search, the discovery is made that there are two classes of principles to be applied as well as two classes of inventions. As an example of the preceding remarks, an original invention is a device or process whereby one person may converse in the ordinary voice with another at a distance of several miles, and it is observed to apply the principle that a current of electricity may be set into rapid vibration by the mechanical vibration of two or more electrodes inserted in the circuit. This is a purely scientific principle, and in the future will doubtless constitute the foundation of still further original invention. The crudest device for applying this principle to the conveyance of sound is the original invention, while all the telephones which have been invented since the first are derived or secondary inventions.

If a device, however crude, were invented, so that we could see things at a distance by means of the current, the device would be an original invention, and all the subsequent inventions on the same subject would be derived inventions, provided the same fundamental scientific principle were applied both in the original and in the derived inventions.

The first device for converting motion into electricity by magnetic induction was an original invention, while all those which have been invented since, involving the same fundamental principle, are derived inventions.

In the eye of the inventor, all the inventions which now exist are crude and need much improvement. He is not satisfied with the state of the art as disclosed by present patents. He believes that nothing is so good in this world but that it may be made better. It was on account of the above considerations that our rule 7 was enunciated, reading thus:

"7. Decide upon one of the crude inventions, and make improvements upon the same."

Having given several hundred electrical principles and several scores of subjects for invention, it is only necessary to apply the principles to the subjects, or to present the subjects to the principles, according to directions already given, in order to devise an invention involving different principles from those already applied by a previous inventor.

Just as original inventions are applications of scientific principles, so improvements are applications of principles, the nature of which will be best understood by their immediate enunciation and consideration. They are not deduced from *experiments*, but from *experience*. In order to apply them, the same specific directions should be followed as in the case of the hundreds of scientific principles already given. They may be indicated in many cases by a single word.

1. AUTOMATIC.—Having made a crude invention, or having studied the present state of inventions on any particular subject, especially if it is in a new field of some late discovery or great invention, it may happen that there is some feature apparently necessitating the use of a force external or extra to that which causes the device in general to operate; or there may be more than one feature which may be made automatic in its nature. To make an automatic device in some previously existing invention has often resulted in such an important improvement as to render the device a hundredfold more valuable.

Consider the importance of the eccentric of an engine and all its equivalents, and how by its means the very force which propels the piston regulates itself in its action upon the piston!

In the era of the invention of the telegraph, automatic devices under the name of telegraph relays were introduced whereby a message could be sent thousands of miles by the assistance of a current strong enough to send it only hundreds of miles. Before the relay was invented, a message could be sent a long distance by repeating the message from station to station by the agency of operators; but how much quicker and more accurate and convenient is the relay which introduced the automatic principle!

In sending messages long distances by telephone, the only way at present consists in an unreliable method which may appropriately be compared to the process of tradition or gossip, where the message at the other end is very likely to be changed into a different story by passing through so many human ears and mouths. So long as it is impracticable to make one telephone talk a great distance, let the element of the "automatic" be introduced into this department of telephony.

Perhaps one of the most interesting applications of this principle is seen in the electric dynamo, where the current is directed into the mains at each instant the various coils of the armature become located in the maximum magnetic field, while the coils are moving with wonderful velocity.

The commutator, as this part of the dynamo is called, is the whole soul of the invention, as without it the dynamo would have about the same appearance, and yet it would be impossible to obtain a current from it except in the case of one or two unusual forms of dynamo.

Instead of depending upon the faculties of the inmates and servants of a hotel to give warning of fires by means of the push button and electric bell, the wonderful improvement was made in the application of the principle of operating the push button automatically; *i. e.*, by the very force, heat, which destroys the property. This invention certainly shows the persistency of man to make fire his servant, even when it tends to be his master.

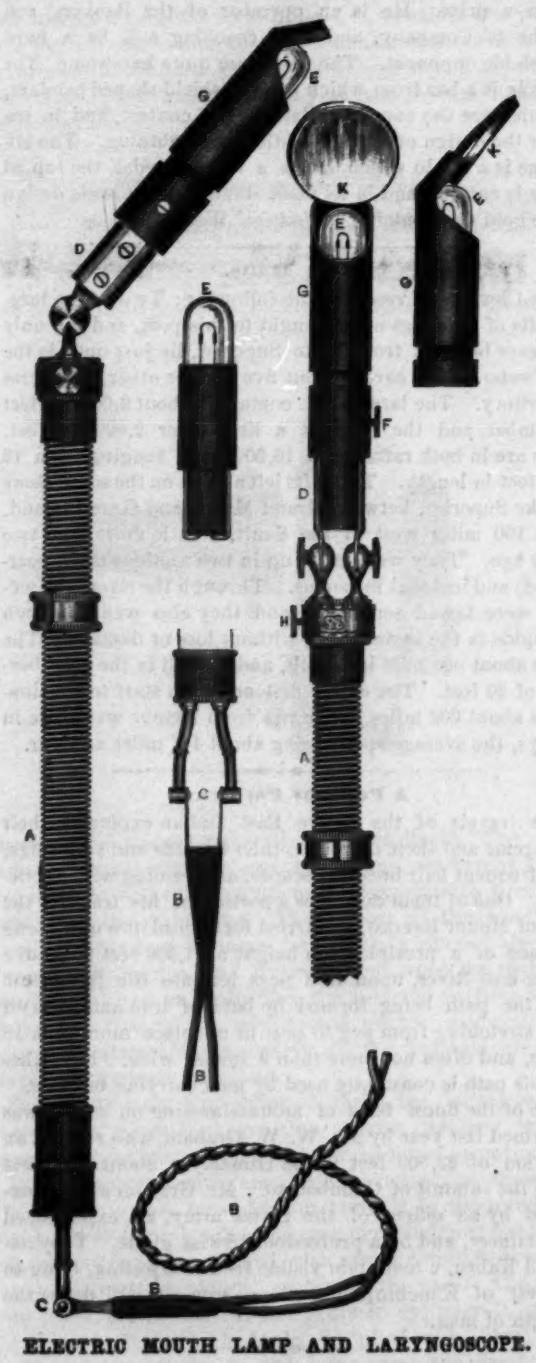
In all devices and processes motion or force occurs in the form of electricity, magnetism, heat, light, chemical affinity, or mechanical energy. As a consequence, and as "automatic" involves the idea of the presence of force, every device or process is adapted to be made automatic. In order to proceed systematically, notice the following analytical directions and considerations: *A*. Because it is advantageous in many cases to introduce an automatic device, yet it is not necessarily always an advantage. As to whether the uses are valuable or not, can be determined only by making the invention first and the trial next.

Take such a simple device as an ordinary writing pen. The question to be answered first by any inventor of a fountain pen is in reference to the advantage of introducing the element of the "automatic." While moving the hand from the paper to the inkstand in the writing of a page, as much time is occupied as in writing a consider-

ELECTRIC MOUTH LAMP AND LARYNGOSCOPE.

In diagnosing lesions of the teeth and associated parts the small electric lamp shown in the accompanying engraving will be found an invaluable assistant to the dentist, and by its aid the exact location of the disease may be determined. By the use of the appliances heretofore in vogue this could not be accurately ascertained, and as a consequence many sound teeth have been sacrificed in the fruitless search for the seat of neuralgic pains for which, owing to the insufficiency of the means of diagnosis, no satisfactory cause could be established. This lamp illuminates the oral cavity so brilliantly that any departure from normality can be unerringly detected; and as it is placed within the arch, behind the object to be lighted, its rays fall upon the lingual surfaces of the teeth while the eye of the operator is directed to the labial surfaces, and thus every portion of the teeth and gums is thrown into strong relief—the sound teeth appearing translucent and showing no variations in texture, while the unsound teeth have an opaque or dark appearance.

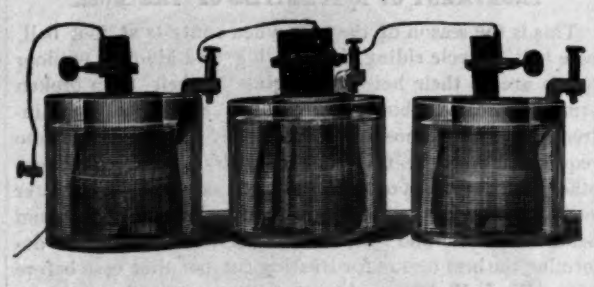
The lamp, E, is an incandescent electric light mounted permanently in a non-conducting case of hard rubber, and provided with metal conductors which pass outside of the smaller section of the case. The lamp is carried in another hard rubber cylinder, D, called the lamp holder, which is also supplied with metal conductors fitting those on the case, the two parts when adjusted being clamped together by the set screw, F, thereby holding the lamp firmly in its socket. The conductors of the lamp holder are connected to the handle, A, by hinged joints, so that almost any desired adjustment can be readily secured. This handle is called a resistance handle because it is wrapped with wire of a low conducting power, by which, through the agency of the ring, I, the flow of current is regulated. When the ring is placed at the end of the handle nearest to the battery cord, the resistance is reduced to the minimum, and the current from the battery flows freely to the lamp. Sliding the ring to the opposite end of the handle compels the current to travel through the wire with which the handle is wrapped to the ring and back again, thus forming a resistance. The connection to the battery cord, B, is made by the spring coup-



ELECTRIC MOUTH LAMP AND LARYNGOSCOPE.

ling, C. A non-conducting shield, G, is placed over the lamp globe for the double purpose of preventing the radiation of heat and of directing the light to any desired point. At H is a screw for breaking the circuit, which should be broken occasionally during a prolonged examination, and also, whenever the lamp is not in use, to prevent its becoming so hot as to be unbearable in the mouth. In order to admit of the examination of posterior cavities a mirror, set at an angle of forty-five degrees, is attached to the end of the guard. With this attachment the lamp forms a perfect laryngoscope.

The battery to operate this lamp consists of three improved Bunsen cells having large carbons. The porous cups are filled with the bichromate solution (made in the following proportion: One-half gallon of boiling water, in which is dissolved half a pound of bichromate of potash; when cold, there are added ten fluid ounces of chemically pure sulphuric acid), and the glass jars with water to which two ounces of chemically pure sulphuric acid are added. This battery is



specially adapted for the work required of it, and produces a strong current of great constancy.

This useful device, which the surgeon and physician, as well as the dentist, will find of great value in the examination of the mouth and throat, is made by The S S. White Dental Manufacturing Company, of Philadelphia, Pa.

Hardening Steel Mill Picks.

When it is desired to harden a piece of steel, it should be known to a certainty for what specific purpose the material is to be used; for instance, it is very reasonable to suppose that a tool that is made to do its work by blows, as a cold chisel, a knife that cuts by means of an even, constant pressure, a tool that must combine strength with cutting qualities, or one intended for soft, another for hard work, must not receive the same treatment in manufacture in order to be good tools for their respective uses.

Take for example the matter of mill picks; these are ordinarily made of cast steel hardened and tempered in an anthracite forge. Double refined cast steel is used, and should be manufactured for this express purpose. In drawing out the steel great need of caution is essential, inasmuch as, if the iron is not worked right, it seems really impossible to temper subsequently. The plan generally followed by the best makers is to draw out the pick with an anvil and hammer, both of which have very smooth faces, and the steel is heated not above a dark cherry red. When it comes to finishing, the best artisans claim the steel should be hammered only on the flat side, and the lighter and more rapid the blows the better the resulting tool, the blows, light and quick, being continued till the steel is quite dark. For tempering, a bath made of two gallons of soft water and two pounds of salt is used; this will last for tempering a dozen picks, but some care is needed not to have the bath too cold, as it tends to chill; hence the workman often dips a hot iron in his bath before he begins to temper his picks. When the pick is at a dark cherry heat, it is dipped just at the point, the rest being cooled in the ordinary way. We suggested mercury to a skilled workman as a good thing with which to temper, but the great trouble is to control this substance for this purpose; it makes the steel so hard that it is brittle, the entire edge often cracking off, so sudden is the reaction.

As to the comparative merits of American chrome and English steel for making picks, opinions vary; though American steel seems to have the most friends. When English steel is used, the tool is heated only moderately in forging—not sufficient to scale—and when the redness leaves it is not hammered; it is hardened by heating to a low red heat, dipping in warm salt water, and tempered to a brown; while with the American steel it is heated to a yellowish color for forging, to a low red for hardening, and at once quenched.

The best weight for a pick seems to be about four pounds, and to be perfect should be ground only with moderate pressure, with plenty of water, down to the edge, but not sharpened on a large stone.—*Midland and Industrial Gazette.*

Value of Hay for Stock.

Experiments have been made in England as to the comparative value of good hay for stock, with the result that it is estimated that 100 pounds of hay are equal to 275 pounds of green Indian corn, 400 pounds of green clover, 442 pounds of rye straw, 360 pounds of wheat straw, 160 pounds of oat straw, 180 pounds of barley straw, 153 pounds of pea straw, 200 pounds of buckwheat straw, 400 pounds of dried corn stalks, 175 pounds of raw potatoes, 504 pounds of turnips, 300 pounds of carrots, 54 pounds of rye, 46 pounds of wheat, 59 pounds of oats, 45 pounds of mixed peas and beans, 64 pounds of buckwheat, 57 pounds of Indian corn, 68 pounds of acorns, 105 pounds of wheat bran, 167 pounds of wheat, pea, and oat chaff, 179 pounds of mixed rye and barley, 59 pounds of linseed, and 330 pounds of mangel-wurzel.

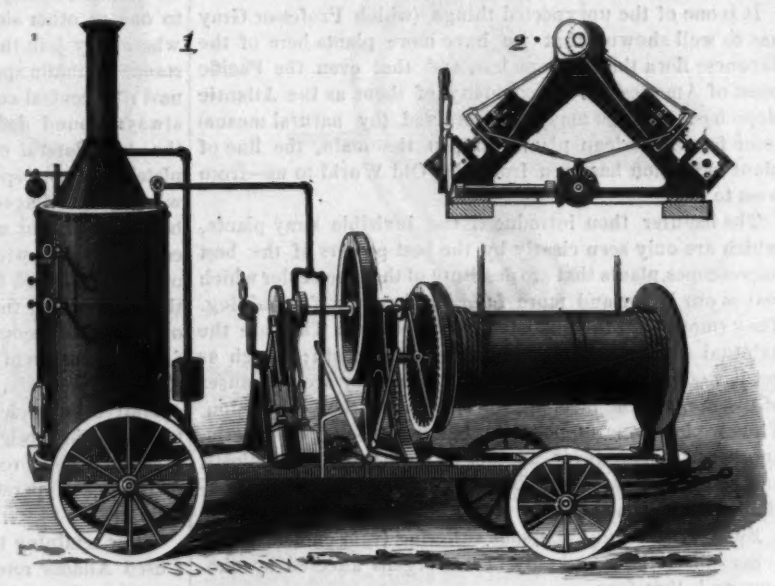
Acorn Bread.

The Indians scattered along the foot-hills of the Sierra are a quiet, inoffensive people. They do not appear to be governed by any tribal laws, yet adhere to many of their old traditions. One or two men of superior ability and industry form a nucleus around which others less ambitious gather. Hence they fence with brush and logs a tract sufficient for their requirements of hay-making, pasturage, etc. Although they often indulge in the food of civilized nations, the acorn is still a favorite article of diet in every well-regulated wigwam. The process of converting this bitter nut into bread is curious. Under the branches of a grand old pine I found them at work. They had shucked and ground in the usual manner a large mass of the acorn meats. A number of circular vats had been hollowed out of the black soil, much in the shape of a punch-bowl. Into these was put the acorn pulp. At hand stood several large clothes-baskets filled with water, and into these they dropped hot stones, thus heating the water to the required temperature. Upon the mass of crushed bitterness they carefully ladled the hot water, making it about the color and consistency of cream. Not a speck appeared to mix. A buxom *muhala* stood by each vat, and with a small fir bough stirred the mass, skillfully removing any speck that floated upon the surface. The soil gradually absorbed the bitter waters, leaving a firm white substance, of which they made bread. I asked to taste it, at which they said something in their language, and all laughed. I asked again, and after more laughter I was handed a small particle on a fig leaf, and found it sweet and palatable. They began to remove it, and so adroitly was this done that but a small portion adhered to the soil. They spread it upon the rocks, and in a short time it was fit for use. This, I am told, they mix with water, put it into thin cakes, and bake before the fire.—*San Francisco Chronicle.*

HOISTING MACHINE.

The boiler, engine cylinders, the hoisting drum, and all the other parts of the machine are supported upon a truck resting upon wheels. The bed plate carrying the boiler and engines is formed with rear stands on which the cylinders are attached at an inclination of forty-five degrees. The stands are made with guides for the crossheads, and the rods are connected to the same wrist pin on the crank disk of the shaft, so that the engines work at right angles and carry each other over the dead center. The driving shaft carries two eccentrics for operating the valve rods of both engines through the medium of links. (The construction and arrangement of these parts are shown in Fig. 2.) By the movement of a lever the links are simultaneously shifted to reverse the engines.

On the driving shaft is a pinion, attached by a feather, so that it can be moved on the shaft by means of a lever to engage with the internally toothed rim on the end of the drum. The rim is provided with flanges, between which is



VIERNOW'S HOISTING MACHINE.

a brake strap operated by a lever. The drum is in two parts, the larger portion fixed on the shaft and the smaller end portion fitted to slide on the shaft, the two parts being connected by pins in a middle head. A nut holds the sliding part up to place, so that when it is necessary to take up or let out the hoisting rope the nut is screwed back and the part moved on the shaft, and then rotated to wind or unwind the rope. The ropes pass off from opposite sides of the drums over pulleys, and to the platforms, so that in operation one platform is raised as the other is lowered. By this construction and arrangement the machine is rendered very compact, and can be conveniently operated, especially for supplying material to buildings in course of erection, and it can be easily moved from place to place.

Further particulars concerning this machine may be obtained by addressing the inventor, Mr. G. M. Viernow, Room 33, S. E. corner Olive and Fifth Streets, St. Louis, Mo.

GOVERNOR BEGOLE, of Michigan, in a late address asserted that he had found, from an accurate study of statistics, that 91 per cent of the crime and pauperism of the State came directly from the use of intoxicating drinks.

Stray Plants.

An interesting botanical lecture was lately delivered by Prof. Rothrock, in Horticultural Hall, Fairmount Park, Philadelphia, on Stray Plants. The lecturer stated that he did not intend confining himself to those larger plants which we can all see, but would embrace also a brief statement of those minuter forms which we never see by the unaided vision, and whose presence was only generally recognized by the evils which they wrought and by the enormous death rates which they induced.

Twenty years ago or more, Bentham and Hooker, the two most distinguished English botanists, began preparation of their great book, the Genera Plantarum. It was intended to bring together in the natural order of their structural affinity all the flowering genera of the existing flora on the globe. What are genera or, as used in the singular, what is a genus? All the species of pine constitute one genus, all the spruces another, all the firs a third, all the cedars a fourth, and all these are grouped in the order of cone-bearing trees. Modern science teaches that all these have descended from a few species of parent plants, and that time and physical surroundings have produced the variations we now see in the vast aggregate of plants representing the order. A study of the Genera Plantarum shows a marked *tendency* in the smaller orders to a localization in a portion of the globe. The larger orders are, as might be expected, more widely spread. The very increase in the number of their genera implies the greater diversity of physical condition which they have encountered in their descent through the ages. Genera are in the main more localized than the orders. This, too, is to be expected. Thus, for example, the genus Crassula, of 120 species, was mainly localized at the Cape of Good Hope. Just in the same way the asters and golden rods found their maximum development in our own region. Sometimes, however, plants would wander off from their birthplaces. Illustrating this, we had the hickory group, of which there are but ten known species. Nine of these grow in the United States and one in Mexico. It is strange that the Mexican species has a four-winged fruit, and stranger still that the Pecan hickory, which, on the whole, is its nearest geographical associate, should also show a marked tendency to the production of fruit of the same kind.

Just, too, as there were in the past vast migrations of men who invaded and took possession of other lands after extirpating the native population, so there had been such migrations among plants. The original forest on the island of Saint Helena had been superseded by European cone-bearing trees. Instances of the same thing on a much larger scale could be named. The strangest examples were where the same species of plant would be found here and in Japan, but nowhere else. Our blue cohosh was such an instance. Hardly less remarkable was it that of the two species of podophyllum (May apple), one grew here and the other in the far-off Himalaya region. We have no reason to doubt that they are blood relatives, but how is it that one or both have strayed from the original birthplace?

It is one of the unexpected things (which Professor Gray has so well shown) that we have more plants here of the Japanese flora than Europe has, and that even the Pacific coast of America has not so many of them as the Atlantic slope has. Europe may have received (by natural means) some few American plants; but, in the main, the line of plant migration has been from the Old World to us—from west to east.

The lecturer then introduced the invisible stray plants, which are only seen clearly by the best powers of the best microscopes, plants that are destitute of the green color which makes our larger and more familiar forms self-sustaining. They (more than the mistletoe) are parasitic. They are the habitual associates of decay, disease, and death; though as yet it would be premature to assert that they are the causes of disease, yet the facts appear to point to that conclusion. Thus we have one supposed to be the cause of diphtheria, another of splenic fever, another of pulmonary tuberculosis, and another of cholera. Take the one last named (comma-shaped), *i. e*, that of cholera.

First. It is found in persons suffering from cholera.

Second. It is found only in the organs affected by cholera, and, therefore,

Third. It is not found in healthy persons.

Fourth. It diminishes in numbers as the patient convalesces. Hence it is proportionate in number to the gravity of the disease.

Fifth. It has marked powers of locomotion.

Sixth. It lives and multiplies rapidly in the clothing of cholera patients if this be kept damp for twenty-four hours.

Seventh. It will die if kept dry for twenty-four hours.

Eighth. It develops only in substances which have an alkaline reaction.

Ninth. It dies when brought in contact with solutions which contain only a little free acid.

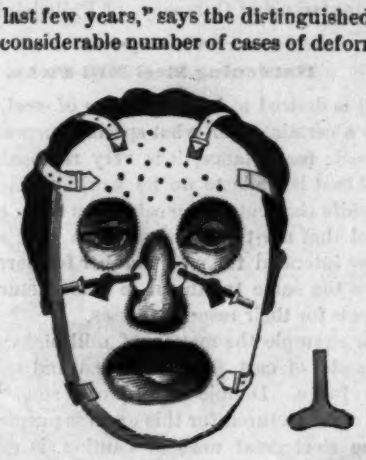
These are substantially the conclusions reached by Koch, who has been the most careful investigator of the subject. Clearly they point to the following cautions in cholera seasons: Cleanliness of the person, of the clothing, and of the surroundings; isolation of cholera patients; destruction by fire of clothing and bedding used by the sufferers; absolute purification and frequent acidulation of drinking water, and the rejection of all water which can in the slightest degree be tainted with sewage from cholera infected districts. All of these conclusions are amply sustained by the experience which epidemics have but too largely furnished. One thing more the importance of this subject teaches. It is, that local, State, and national health boards should be absolutely free from political restraints or from any measure of party expediency; that they should be invested with power which is final; and that they should have the support and active co-operation of every good citizen.

These germs of disease then come fairly under head of Stray Plants. They float in the air we inhale and in the water we drink. And once started in their career of destruction, it is possible for them to incircle the globe with badges of mourning.

TREATMENT OF DEFORMITIES OF THE NOSE.

This is the season of the year when contests at foot ball, base ball, bicycle riding, fox hunting, and kindred outdoor sports are at their height, bringing in their train broken arms, dislocated shoulders, sprained ankles, and not infrequently broken noses. The surgeon's skill is called into requisition more at this time of year than at almost any other, and the cause of this results in casualties of a greater variety than occur to persons in their ordinary pursuits, and hence the doctor and surgeon is sometimes puzzled to determine the best means for treating the peculiar case before him. W. J. Walsham, Assistant Surgeon in charge of the Orthopædic Department at St. Bartholomew's Hospital, London, communicates through the *Lancet* his experience in treating deformities of the nose following injury, which is timely, and will no doubt be found useful to the surgical profession.

"During the last few years," says the distinguished writer, "I have had a considerable number of cases of deformities of



MASK FOR STRAIGHTENING THE NOSE.

the nose due to injury under my care; and as the treatment of such deformities is but lightly touched upon in works on surgery, it may be interesting to some to learn the result of my experience. . . . For convenience of treatment they may be divided into those affecting, first, the lateral cartilages and, second, the nasal bones.

"1. *The Cartilages.*—These may be variously bent or twisted to one or other side, or they may be depressed at the spot where they join the nasal bones, giving the nose in this instance a sunken appearance. In the former case the septum nasi (the central column of support) will as far as I know be always found deflected in a direction opposite to that of the bent lateral cartilage, blocking up more or less completely the correspoding nostril. In the latter case, *i. e.*, when the cartilages are depressed, the septum may not only be deflected, but also, as is unfortunately too often the case, fractured with lateral displacement of the fragments, or else dislocated from the maxillary crest. In addition to the deformity, therefore, there will exist the usual train of symptoms accompanying nasal stenosis from other causes, *i. e.*, a sensation of stuffiness in one or both nostrils, a nasal tone of voice, etc. In neither class of cases will either operative or mechanical treatment alone suffice. The septum must be straightened, and the lateral cartilages at the same time be forced into position, and there retained by mechanical apparatus till the septum has had time to consolidate.

For retaining the septum in position, in my earlier cases, I used Adams' retentive apparatus, modified so as not to injure the columnella. More recently I have had an instrument made of vulcanite, which, however, is open to the objection that the vulcanite is apt to become softened by the heat of the nose, and lose its shape and retaining powers. The advantages of the softer vulcanite may be obtained by having the blades of a steel instrument coated with this material. For solid ivory plugs I have now substituted hollow plugs of vulcanite, which can be worn with greater comfort, as they allow the patient to breathe through them. Many forms of retentive apparatus for holding the lateral cartilages in position were in use before I found one which fulfilled all the indications. At first the ordinary nose truss, which is fastened to the forehead by a band round the head, was tried. This, however, proved of little service, inasmuch as it is liable to shift, and thus give no fixed point to work from. The same objection holds to the spectacle method of fixing the truss. At length this difficulty was overcome by having a mask accurately moulded to the face, as shown in the accompanying wood cut. A plaster of Paris cast is first taken of the face, and in this the leather for the mask is moulded, apertures being left for the mouth, eyes, and nose itself. The mask when thoroughly dry is lined with soft chamois leather, and fits accurately to the irregularities of the face, so that no movement can take place. It is secured by suitably arranged straps around the head. Having thus obtained a fixed point to work from in the mask, it is easy to bring pressure to bear upon the nose in any direction required by means of suitable screws, springs, etc., attached to the mask."

A Telegraphic Contest.

A prize contest for fast telegraphic transmission took place, on August 17, in the Western Union Telegraph Company's building. The prizes were three in number—the first a gold medal, the second a silver medal, and the third a decorated telegraph key. They were given by J. H. Bunnell & Co., of New York, and the only conditions were that the Morse steel lever key should be the one used. The prizes were for "clearness of character and speed combined." The judges of the contest were J. H. Dwight, night force manager; W. B. Waycott, cable manager; and E. F. Howell, chief operator, all of Western Union. The affair was in charge of Mr. F. Catlin, chief operator.

At eleven o'clock, when the contest began, over one hundred leading operators and telegraph managers were present. On a printed slip was the work to be done. This consisted of 500 words, 15 periods, and 4 commas, in all 2,368 characters, as published in the *Operator* of August 15. The messages were sent on a local circuit. There were ten contestants, all of whom did remarkable work, and at one o'clock the contest was finished. Shortly afterward the judges announced their decision, which was as follows: First prize—W. L. Waugh, "superior" work, each letter and character perfect; time, 11 m 27 s. Second prize—W. M. Gibson, "good" work; time, 11 m. 3 s. Third prize—F. J. Kihm, "fair" work; time, 10 m. 32 s. It is notable that not one of the winners is a Western Union man, Waugh belonging to the Commercial Telegram Company Stock Exchange, Gibson to the Bankers' and Merchants' Stock Exchange, and Kihm to the United Press Association.

The names of the other contestants, with their time, are as follows: J. W. Roloson, 10 m. 10 s.; L. E. Liddy, 11 m. 58 s.; M. J. Doran, 11 m. 32 s.; W. A. Hennessy, 11 m. 51 s.; E. Delaney, 11 m. 52 s.; Harry Ziegler, 12 m. 29 s.; P. J. Byrne, 13 m. 50 s.

Roloson's time of 10 m. 10 s. is the most remarkable on record, but his work was too indistinct and unreadable to obtain a prize. He is an operator of the Bankers' and Merchants' Company, and with coaching will be a most formidable opponent. The prizes are quite handsome. The gold one is a bar from which hangs a shield-shaped pendant, on which are the name and date of the contest, and in the center the design of a hand holding the lightning. The silver one is a bar to which hangs a round medal, the top of which is cut out, and in its place stands out the same design as the gold one contains.—*Electrical World.*

Great Rafts.

The Cleveland *Press* tells the following: Two of the largest rafts of pine logs ever brought to this port, and the only rafts ever brought from Lake Superior, lie just outside the breakwater. One covers about five and the other eight acres of territory. The largest raft contained about 3,000,000 feet of lumber, and the smallest a little over 2,000,000 feet. There are in both rafts about 16,000 logs, ranging from 12 to 16 feet in length. The rafts left a point on the south shore of Lake Superior, between Grand Marias and Grand Island, about 100 miles west of the Sault, a little more than two weeks ago. They were made up in two sections each, pear-shaped, and inclosed in booms. Through the rivers the sections were towed separately, and they also went through the rapids in the same shape, without loss or damage. The run is about one mile in length, and the fall in the neighborhood of 20 feet. The entire distance from start to destination is about 600 miles. The run from Detour was made in 14 days, the average speed being about 1½ miles an hour.

A Perilous Pathway.

The travels of the native East Indian explorers, their stratagems and their disguises, their hazards and sufferings, their frequent hair-breadth escapes, are teeming with excitement. One of them describes a portion of his track at the back of Mount Everest, as carried for a third of a mile along the face of a precipice at a height of 1,500 feet above the Bhotia-kosi River, upon iron pegs let into the face of the rock, the path being formed by bars of iron and slabs of stone stretching from peg to peg, in no place more than 18 inches, and often not more than 9 inches wide. Nevertheless this path is constantly used by men carrying burdens.

One of the finest feats of mountaineering on record was performed last year by Mr. W. W. Graham, who reached an elevation of 23,500 feet in the Himalayas, about 2,900 feet above the summit of Chimborazo. Mr. Graham was accompanied by an officer of the Swiss army, an experienced mountaineer, and by a professional Swiss guide. They ascended Kabru, a mountain visible from Darjeeling, lying to the west of Kanchinjunga, whose summit still defies the strength of man.

Burnt Umber.

To produce this most important pigment the crude umber is put in iron retorts and subjected to a heat more or less intense. The result is the changing of the tone of the color to a very much deeper and more red brown. The drying property is also increased by burning. Burnt umber, with white and orange chrome yellow, will give a variety of shades of clear warm drabs. Burnt umber, with white and lemon chrome yellow and scarlet lake, will give a rich shade of tan color.

able number of words. The change of position of the body and its parts and the change of thought, cause an additional period of useful time to be lost. The force existing in a pen and ink is capillary force—*i. e.*, one form of mechanical force. To let his force feed the ink into the pen effectually and automatically has been found by many to be an advantage, and more and more people seem to be added to those who realize the advantage of a good fountain pen. In the lead pencil, however, there appears no advantage in making it automatic in the same sense, as it may be used for a very long time even without any adjustment or change being needed, and to sharpen it occasionally is little trouble and occupies in the aggregate little time.

B. The advantages of an automatic device or process consist in its saving time or labor, or else in the accomplishment of better results, or in all these points combined. Seek, therefore, to discover if any time is unnecessarily lost, or if labor is unnecessarily expended, or if better results should be expected. Concerning automatic "cut-outs" in electrical circuits, it may be pointed out that time is saved because the incandescent lamp and other translating devices are saved.

To employ an automatic damper for a stove or furnace is a saving of coal, which is an equivalent of labor, and its employment results in an equalization of temperature.

C. The third step consists in determining one or more of the forces which may be made the controller and operator of the device. For examples: An automatic door or gate which will open at the approach of a man, vehicle or boat, utilizes the mechanical force of the moving object; an automatic electrical instrument generally utilizes the force of the current; a thermostat allows the force of heat to set it in operation, and there is an automatic heat signal which shows roughly by its color how high the temperature is, the color changing on account of the chemical action which is produced at a certain temperature.

D. Having determined the force at hand, the next step consists in the application of this force to the accomplishment, through a mechanical device, of the results, which will be a saving of time and labor.

E. To apply this force automatically, requires a device which must be invented according to the rules already laid down for original invention—*i. e.*, consider every subject for invention and make automatic those which are not already automatic, and improve those which at present are; then apply practically any of the several hundred principles given.

(TO BE CONTINUED.)

Electric Laryngoscope and Otoscope.

The old apparatus known as laryngoscopes and otoscopes bear little resemblance to those in present use, and the

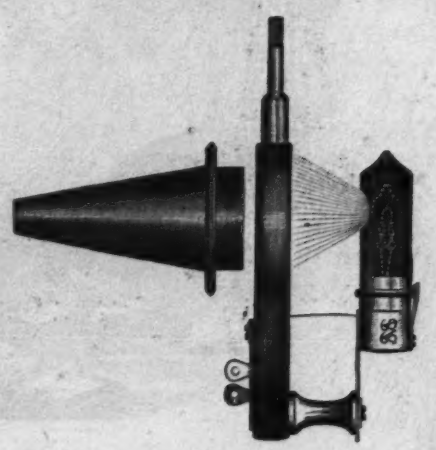


FIG. 4.

cause of the change naturally suggests itself. The older forms required either a gas or oil flame, numerous lenses and mirrors, and other cumbersome apparatus to direct the light upon the right spot. The advent of the small and durable incandescent lamp immediately opened the way for a simplification and improvement upon the methods before employed in examining the internal cavities of the body, and this change consequent on the resort to electricity is noticeable in nearly all the instruments now employed for such purposes.

One of the most important of these, the laryngoscope, occupies a prominent position among medical instruments, and, as such, its latest form deserves attention.

In the electric mouth-lamp and laryngoscope shown in Fig. 1, the small incandescent lamp *E* is mounted permanently in a non-conducting case or cylinder of hard rubber, and the lamp is supplied with metal conductors which pass outside of the reduced section of the case. The lamp case is carried in another hard-rubber cylinder *D*, called the lamp-holder, which is also supplied with metal conductors fitting those on the lamp-case, the two parts when adjusted being clamped together by the set-screw *F*, thus holding the lamp firmly in its socket. The conductors of the lamp-holder are connected to the handle *A* by hinged joints, so that almost any desired adjustment is readily secured. This handle is wrapped with wire of a low conducting power, by which, through the agency of the ring *I*, the flow of the current is regulated. When the ring is placed at the end of the handle nearest to the battery cord, the resistance is reduced to the minimum, and current from the battery flows freely to the lamp. Sliding the ring to the opposite end of the handle compels the current to travel through the wire with which the handle is wrapped, to the ring and back again, thus

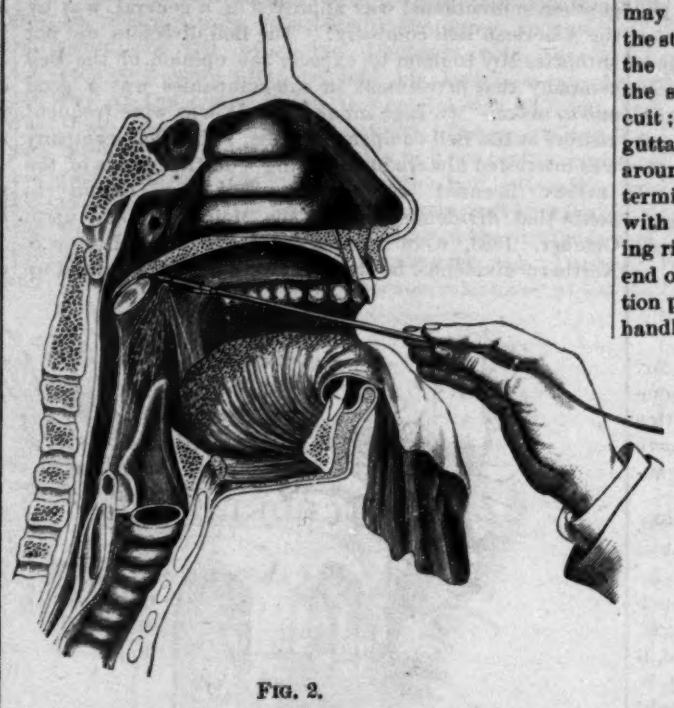


FIG. 2.

forming a resistance. The connection to the battery cord *B* is made by the spring-coupling *C*. A non-conducting guard or shield *G* is placed over the lamp-globe for the double purpose of preventing the radiation of heat and of directing the light to any point desired, while at *H* is a screw for breaking the circuit.

Fig. 2 shows the manner in which the instrument is applied and the cavities which can be illuminated by it. The details of another similar instrument there applied are shown in Fig. 3.

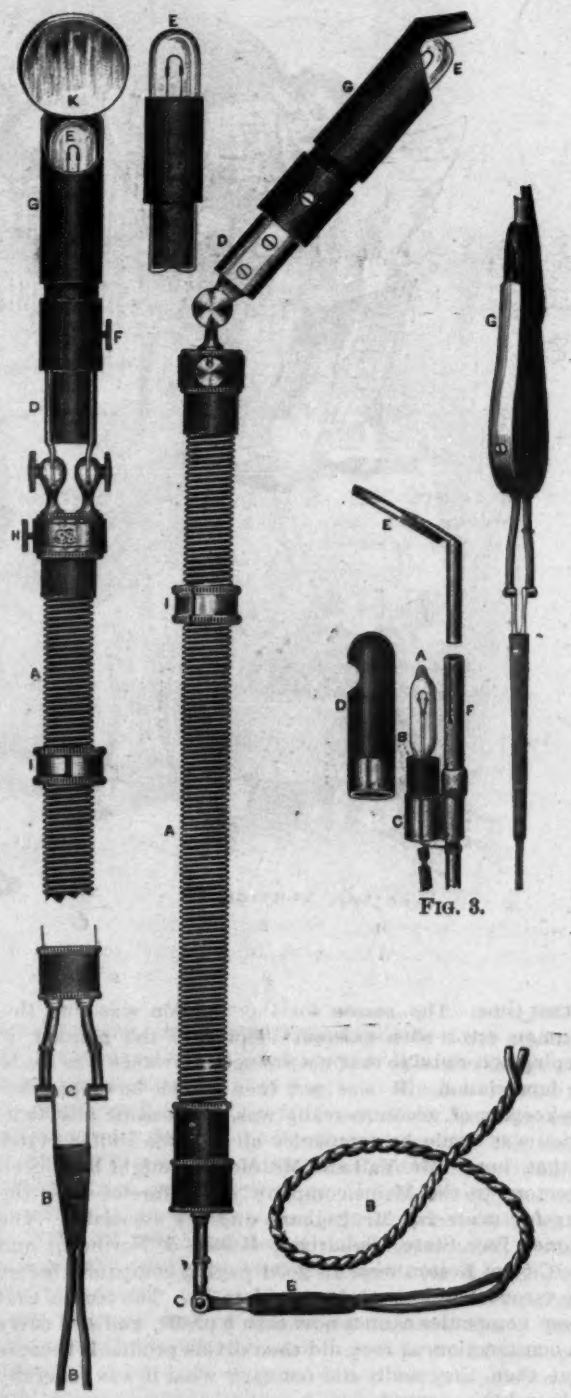


FIG. 3.

FIG. 1.

In this appliance the incandescent lamp *A* is mounted on a vulcanite base *B*, set in a metal sleeve *C*. A non-conducting guard *D*, with an aperture for the transmission of the light rays, covers the lamp, and the guard turns freely, enabling the operator to direct the light as he desires. The sleeve *C* is connected to the metal stem of the handle by means of a sliding ring, and the lamp may thus be moved up and down or revolved around the stem in any position. The lamp-wires pass through the lamp-base, one of them being wound around the stem a few turns, making it a part of the circuit; the other lamp-wire is connected with the gutta-percha-covered conductor, which forms a spiral around the stem, passing through the handle to one of the terminal posts. (The stem of the handle communicates with the second terminal.) The mirror is held by a sliding ring in clamping jaws, formed by splitting the outer end of the handle extension. This method of organization permits of the use of different sizes of mirrors. The handle proper is of hard wood, and is provided with a spring *G* which makes and breaks the circuit. In use the handle is held between the thumb and forefinger, the spring being pressed by the second finger to complete the circuit.

The electric otoscope shown in Figs. 4 and 5 is designed for the purpose of diagnosing and treating diseases of the ear. It possesses the advantage that, while illuminating the parts perfectly, it does not interfere with the use of instruments.

As will be seen, the lamp is adjustable, so that the light can be thrown in any direction. The hard-rubber speculum is placed in a non-conducting frame carrying the lamp and the conductors, and a handle is provided (which screws on at the thread shown), so that after the otoscope is adjusted the patient may hold it in position, leaving both of the operator's hands free for the use of instruments and the application of medicaments. The conducting cords are coupled to the posts and the small end of the speculum inserted in the ear.

These instruments, which are made by the S. S. White Dental Mfg. Co., of Philadelphia and New York, are evidently a great advance on the old forms, and the results obtained with them are greater celerity and certainty in curing diseases.

Incandescent Lamp Tests at Philadelphia.

In our issue of March 14 last we gave in detail the manner in which the tests of various types of incandescent lamps were being made under the direction of the Franklin Institute. We stated at that time that the efficiency tests were complete and that the duration tests to determine the life of the lamps had been begun.

As we go to press a New York morning paper announces in a telegram dated from Philadelphia, that "in the test

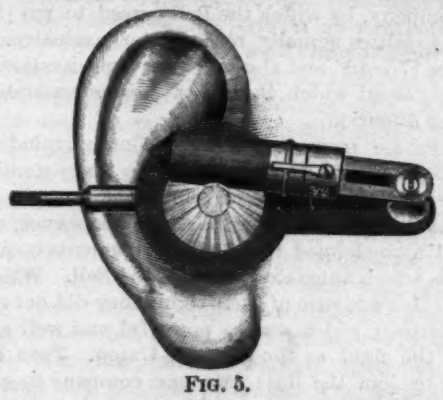


FIG. 5.

as to the relative duration of the lamps of the various electrical companies the result thus far is as follows: Lamps destroyed out of twenty at the end of 305 hours—Weston, 11; Stanley, 12; Woodhouse & Rawson, 10; Edison, 1."

In the absence of any official statement or report, nothing definite can, as yet, be asserted, and the figures are to be accepted with reserve. Standing by themselves, the duration tests of the life of the lamps, however, tell but a partial story, and to judge by inference would, in this case, be manifestly unfair. We hope soon to be able to present the full figures to our readers, when legitimate comparison and full discussion will be in order. The duration test referred to is to last 600 hours, of which only about 400 have passed.

The Cost of Lighting New York Streets.

A statement of the relative cost of illuminating the streets with the electric light and gas was placed before the New York Board of Aldermen last week by Secretary S. McCormick, of the Gas Commission. At present there are in use 647 electric lights, costing the city $165,308.50 per annum. Resolutions passed by the Board of Aldermen provide for the introduction of 2,093 more, the cost of which would be $534,761.50. The lights now in use displaced 3,016 gas lamps, which cost the city $52,780, or $112,528.50 less than is now paid for the electric lights. The lights which the Board of Aldermen have asked for would displace 5,345 gas lamps, the cost per annum of which would be $93,537.50 or $441,224 less than would have to be paid for the electric lights. The total excess of the cost of the electric lights now in use and asked for

over gas lamps for the same area would, therefore, be $553,752.50 per annum.

The cost of the 2,093 electric lights, $534,761.50, would provide for 30,557 gas lamps. If all the lamps which the Board of Aldermen ask for should be supplied, there would be within that part of the city south of Harlem 2,740 electric lights, costing $700,070 per annum, and 13,685 gas lamps, costing $232,986.50, making a total for lighting that portion of the city of $932,956.50. To this is to be added $117,630 for lighting the annexed district, making a grand total for illuminating the city of $1,050,686.50.

Mr. McCormick advises against the removal of the gas lamps in districts now illuminated by electric light, as the city may some time be forced to fall back on gas. "I have not," says the secretary, "discovered any advantage the electric light possesses that cannot be obtained from gas lamps except the instantaneous lighting."

Investigating the Telephone Business.

We give below the statement made last week by Mr. Wm. H. Forbes, president of the American Bell Telephone Company, before the Massachusetts Legislative Committee on Mercantile Affairs, dealing with the petition to have telephone companies in the State placed under closer supervision.

Mr. Forbes said he appeared before hearings in 1880, when the act of incorporation was asked for. He was asked by Mr. Lilley if at that time assurance was given that no increase of rates would be made, and answered that no such assurance was ever given by authority by any one. He never heard of any such assurance being given, and it would have been a foolish one to make, as it could not be known then what the business of telephoning would amount to. The more subscribers there are in an exchange the greater the operating expenses, and consequently a greater tariff is necessary. The company, however, always seek to increase the number of subscribers in an exchange. There is a point which licensees could reach, in the number of subscribers, where the company would lose money unless the rates should be increased. Never heard of a limit being placed upon the number of subscribers which a sub-company might obtain. There is no rule or ratio by which the number of subscribers which will make an exchange a paying one can be decided. Was probably one of the petitioners for the act of incorporation. The National Bell Company was really the petitioner for the act. The American Bell bought the National, and with it a contract between the latter and the Western Union Telegraph Company, which is the same contract which now exists between the American Bell and the Western Union, and it is the same that is now subject to litigation. Under this contract the American Bell pays the Western Union large amounts of money at stated periods, which represents the purchase by them of patent rights from the Western Union Company, by which the Bell agreed to pay 20 per cent. of royalties actually received for exclusive rights therein for 17 years, and also for other considerations, and the matter, about which there is a misunderstanding, is now under litigation.

The purchase from the Western Union included the Edison telephone, the Gray telephone, a large number of telephone instruments, and certain other property. The object was to get possession of these telephones, as the Western Union claimed that their instruments comprised inventions which antedated those of the Bell. While the American Bell felt sure of their rights they did not care to fight a company which was so powerful and well able to continue the fight as the Western Union. Then it was necessary to join the lines into one company to placate towns and cities through which the wires run, and also for the purpose of making the business better paying for both companies. Since 1878 it has always been the policy of the company to interest local capital. He thought licensed companies in this part of the country were largely dependent upon local capital. The reason for the present depressed condition of the New England company was the same as that for the depressed condition in other companies throughout the United States, and also for the depression in many other kinds of business. Nearly all of the net earnings of last year were devoted to reconstruction. The net earnings of the New England company are about $120,000 or $130,000 a year, and if it were not for paying so much for new work a fair dividend could be paid. The policy of the New England in continuing construction was adopted by its directors unanimously, they believing that it was better to do so than to allow the opportunity of development to pass by. There is very little doubt that if a majority of the stockholders of the New England wished to stop construction, the American Bell directors would not have insisted upon continuing construction. Knew nothing of the National Bell being transferred to Mr. Ingham and his associates. Mr. Vail was authorized to voice the sentiments of the American Bell company in some things and in others he was not. By no vote of the American Bell or instructions from Mr. Forbes was Mr. Vail authorized to take a seat as director in the sub-companies to protect the interests of the American Bell. Mr. Madden was in the employ of the company before the witness entered it. He is Mr. Vail's assistant. Messrs. Ingham, Glidden and Downs were in constant communication with the American Bell company, but only as licensees. If Messrs. Vail, Ingham, Madden, Glidden and Downs combined to purchase licensed companies, it was done without the authority of the Bell. Never heard any complaint made by Messrs. Vail, Ingham, Madden, Glidden and Downs about earnings of the Boston & Northern company. The purchase of the Boston & Northern company by the gentlemen mentioned was approved in a general way by the American Bell company. The Bell directors did not authorize Mr. Ingham to express the opinion of the Bell company that investment in sub-companies was a good one to make. Mr. Ingham and Mr. Downs were frequent visitors at the Bell company's rooms. The Bell company was interested always in following out the status of the various licensed companies. Had no reason to doubt that dividends paid by the Maine company up to October, 1883, were honestly earned. The Boston & Northern dividends, he thought, were not fully earned up to that time. The reason for this opinion was that the common error then existent crept into the manner of keeping accounts, so that not enough allowance was made for depreciation. It was not then known how intricate the keeping of accounts really was. The same miscalculation was made by companies all over the United States at that time. Mr. Vail and Mr. Madden might have been directors in the Maine company just before or after the transfer made by Mr. Ingham and his associates. The Maine, Bay State, Suburban, Boston & Northern, and the City of Boston were all good paying companies before the reconsolidation, or appeared to be. The reason that these companies cannot now earn a profit, and still carry on construction, as they did then divide profits, is because that then they really did not earn what it was generally believed they earned.

When the Northern company increased its stock, it paid a portion of the increase to the Bell, for which it received in return a permanent license from the Bell company. The Lowell District Telephone Company was never threatened with ruinous competition if it did not renew its terms so as to make them more favorable to the American Bell company.

Mr. Bruce objected that Mr. Lilley was covering too much ground; that he had partially developed two points without as yet indicating which he intended to make; namely, either that rates should be reduced or that existing contracts should be annulled. Mr. Lilley said it was not his intention to seek to have any contracts annulled. Mr. Bruce held that if Mr Lilley secured what he was after it would practically annul contracts.

Mr. Lilley said he had endeavored to show that the sub-companies could make a reduction to the public with profit if they made the money they said they made in 1882 and 1883.

Mr. Bruce sought to know if Mr. Lilley desired a bill making provisions for each town and city, notwithstanding the differing cost of telephoning in various towns.

Mr. Lilley replied that he did. He thought the difference between towns spoken of was all moonshine.

CHURCH OF
WIRES FURNISHED
A CHURCH OF THIS SORT WOULD BE FREE FROM DEBT
POLICE NEWS
THE WIFE OF THE BOSOM COULD ATTEND SERVICE AND PREPARE THE DINNER
OF COURSE ALL MEMBERS OF A FAMILY WOULD NOT TAKE THE SAME INTEREST IN THE SCHEME
COME MARIA THE CHURCH BELL IS PEALING
EVENING SERVICE
THE PREACHER OF THE FUT
SERVICE A LA T ONE

APPLICATIONS OF THE NE—

Mr. Forbes' idea was that a hand telephone and a transmitter could not be rented in the city of Boston to a subscriber and a fair rate of interest obtained for less than $120 a year, taking into consideration the service given and the many precarious conditions governing the business. And then, at the expiration of the principal patents, there is a possibility of a competing company coming in, notwithstanding the fact that the American Bell's business would have the advantage of being established, and the Bell would receive only manufacturer's royalties on their other patents. There was a provision in the contract with the New England that it should use the Bell's apparatus forever. By this provision the two companies were made joint partners, to protect each other, even after the expiration of patents. This was the end in view in making the provision and Mr. Forbes thought it sufficient.

Mr. Forbes added in reply to questions that from 1876 to 1881 no returns in dividends were made, five years of the life of the patent having passed, and only 12 years being left in which to reap a profit. The company was getting new patents which have 17 years to run, but the most essential patents were obtained in 1876. The patents obtained at a later time are important, but not necessarily

very essential. Aside from the failure of the Boston & Northern company to provide a sinking fund sufficient to cover depreciation, he could not say whether dividends were fairly earned.

Mr. William A. Ingham, of Lowell, vice-president of the New England company, was also called. He said that in 1879 he was, with others, owner of the Lowell district system, comprising a territory of from 5 to 10 miles around. It was one of the first licensees of the American Bell. It finally became merged in the National Bell of Maine, in 1881. The Lowell company's capital when organized was $12,000 or $15,000 and continued about a year, when there were between 200 and 300 telephones in use. Could not tell what the dividends then paid were, but they were remarkably good. The rates charged subscribers were about the same as now. The business of the company during the first year yielded a handsome profit to Mr. Ingham and his associates. After a year, in 1880, the capital was increased to about $150,000. No cash was paid, but each holder was given three shares for every one which he held, the capital having been quadrupled. During 1880 good dividends were paid upon the $150,000. Thought the dividend was less than ten per cent. Immediately after increasing the capital, purchased the Worcester system, and both systems were operated together before dividends were paid upon the increased capital. Mr. Ingham estimated that there were about 1,000 telephones in both systems. The price received from subscribers was then about the same as now. In January, 1881, the Lowell system went into the Maine company, the Worcester system then being a part of it. During the two years the Lowell company was in operation it would be approximately correct to say that large dividends were paid and that some of the stockholders became wealthy. When the Lowell company went into the Bell of Maine, which covered that State, Worcester and Fitchburg were also included in it, Mr. Ingham and his associates purchased the Maine company of Mr. Madden and Mr. Vail and other officers of that company, for $110 a share, and the capital of the Maine company was then $150,000. The Bell of Maine was purchased by a combination, and not by various individuals. The capital of the Maine company was then trebled. No money was paid in for this increase, but two new shares were issued to the holder of each share. When the Maine territory went into the Bell in October, 1883, there were about 4,000 or 5,000 telephones in use, and the charges were substantially the same as now. He could not tell what the dividends paid the Maine company were after he and his associates purchased it. At the consolidation the capital was $500,000, and there were about 5,000 subscribers. The capital was then raised to $1,500,000, on which 4 or 5 per cent. a year was paid, and also the royalties to the Bell. Thought then that the accounts of the company were well kept, but now would say they were not. He believed the dividends paid were as honestly earned as money ever was. Could not tell how much actual cash or its equivalent the $1,500,000 stood for, but perhaps $500,000 would be a fair amount. Mr. Ingham said he did not include in this calculation any franchises, such as rights of way, etc., which were held by the Maine company. Rights of way have cost the companies a great deal of money throughout New England. In 1881, 1882 and 1883, there was much more freedom obtained from private property owners than now. In Worcester, in particular, some large sums have been paid for rights of this kind, and if these rights could not be obtained the telephone business would have to cease. Country property owners have compelled the companies to pay a great deal of money for rights of way. Mr. Ingham could not tell how much money had been paid for such rights at the time of consolidation, but thought they might not have cost more than $100,000, thus making the capital of $1,500,000 represent $600,000 actually invested.

Mr. Ingham and associates purchased the Suburban Company from Messrs. Sawyer and Piper, of Newburyport. Could not tell how much money was paid for the company or how many telephones the Suburban had in use. He suggested that Mr. Glidden could tell. Mr. Glidden did not wish to state without reference to the books. Mr. Bent explained that various men in the combination went into the market to buy the stock, for which different prices were paid, and thus it could not be told by any books of the company what the sum total was that was paid for the whole stock. The capital of the Suburban company was in 1883 increased about 50 per cent., $100 cash paid in for every share that went out. The capital then was about $500,000. In June, 1882, thought dividends were being paid on $250,000 or $300,000. Mr. Lilley said that he was informed that at that time a dividend of $6,280, or 21.53 per cent. a year, was paid. Mr. Ingham said there was never such a dividend paid. When any American Bell officers were directors in the sub-companies, Mr. Ingham did not know that they were such for the interest of the American Bell. Mr. Ingham believed that whatever dividends were paid upon the Suburban stock were fairly and honestly earned.

Witness and his associates bought the Bay State company in the fall of 1881. This company covered all the western part of the State. The stock was purchased of two or three different companies, and of them Bay State was formed with a capital of $600,000 or $700,000. The company paid about 8 per cent. the first year, with the exception of the 30 per cent. of stock held by the American Bell which did not draw dividends, which Mr. Ingham believed was fairly earned; still a part of it ought to have been retained as a sinking fund to meet depreciation. The capital of the Bay State was increased to $1,000.000 before the reconsolidation with the Bell in October, 1883. Mr. Ingham believed that dividends paid by this company were fairly earned.

In regard to a statement made by Gardner W. Hubbard that he had been influenced by representations made by Mr. Ingham and his associates to invest in Boston and Northern stock, Mr. Ingham at first said that he was sure that no such statements had ever been made. He subsequently modified this testimony by saying that no verbal statement had been made. The New England company was again considered. Mr. Ingham explained that from the time when the business was first started up to the time of reconsolidation the outlay was almost entirely for new work. During the past nine months there had been 5,000 changes; 2,200 instruments had been taken out and 2,800 put in, and only between 500 and 600 new subscribers had been obtained. The cost of making these changes is great. Mr. Ingham said the whole telephonic system has been renewed every four or five years, and the cost is not for poles and wires, which require but a small amount of the outlay, but for the bells, switches and changes to be made. During the past nine months the company has spent $300,000 for repairs and alterations.

Mr. C. J. Glidden, of Lowell, treasurer of the Erie Telegraph and Telephone Company, was called. Since the early part of 1879 he had been identified with various ones of the telephone companies as director or secretary and treasurer. The capital of the Lowell district company was originally $15,000, on which a dividend of 2½ per cent., or $375, was paid July 1, 1878; Oct. 1, 1879, on a capital of $27,000, a dividend of 2½ per cent., or $766; Jan. 1, 1880, $34,000, dividend $836; April 1, 1880, dividend $1,080. The capital stock of the Lowell district was, at various times up to when it took in the Worcester and Fitchburg districts, $15,000, $30,000, $40,000 and $160,000. There were about 600 or 700 subscribers, with whom 1½ per cent. a quarter was paid on $160,000. Rentals on telephones were substantially the same as now. The total amount of money paid out in earnings from those subscribers during the time the Lowell district was alone was $5,000—from May, 1879, to October, 1880. At this date Worcester and Fitchburg were taken in, when the capital stock was raised to $250,000. Between the time that the original stock of the Lowell district company was $15,000 and when the amount was increased to $160,000, not more than half of the increase was paid in cash. After taking in the Worcester and Fitchburg companies till merged into the Maine company, the Lowell district company paid, from Jan. 1, 1881, to Jan. 1, 1882, $30,000 in earnings. There were during that time nearly 2,000 subscribers. Earnings were not then wholly made by rentals, as a considerable sum was received for ex-territorial messages. The capital of the Maine company was $150,000. After it was merged with the Lowell district the total capital was $400,000. The Maine had 1,500 or 2,000 subscribers, and at date of consolidation 4,017. The quarterly dividends paid on the capital stock of $400,000, from Jan. 1, 1882, till the reconsolidation, Oct. 1, 1883, were: 2½ per cent., 3, 4, 4, 1¼, 1¼, 1¼. Mr. Glidden could not say what proportion of the $400,000 represented actual property; that is, the cash value, exclusive of all franchises.

Mr. Glidden said he was secretary and treasurer of the Boston & Northern company, which had a capital of $450,000 originally, and paid upon that 8.12 per cent. per annum. At the time of reconsolidation, outside of the stock held by the Bell, $651,400 was the capital. The quarterly dividend paid September, 1883, amounted to $19,542. The amount of dividends from May, 1882, till October, 1883, was $86,952. The number of subscribers was 3,479 at the time of reconsolidation. Was treasurer of the Bay State company, which had a capital, exclusive of Bell stock, of $560,000. Sept. 1, 1882, there were 1,488 subscribers. There was a large ex-territorial business done by this company, and one quarterly dividend amounted to $11,000. From Sept. 1, 1882, to Oct.

HOW MY PURITAN ANCESTORS WOULD HAVE CAUGHT ON TO THIS
A SHAVE AND A SERMON.
NO GOING TO CHURCH WITHOUT YOUR BREAKFAST
AND SOME DAY WE MIGHT HOPE TO CALM THE SAVAGE BREAST WITH A GENUINE, UNADULTERATED BROOKLYN SERMON
FUTURE CONDUCTING
TONE
Kemble

NE—TAKEN FROM LIFE.

1, 1883, $49,000 was paid out in dividends, being a percentage on the capital stock during that time of 8¾ per cent. To summarize the matter, Mr. Glidden said the Suburban, Boston & Northern, Bay State and National Bell of Maine companies paid remarkably good dividends to their stockholders. The rentals to subscribers were then substantially the same as they now are. As far as he knew, the dividends which he had enumerated were earned fairly and honestly. Of this he had not the least doubt. The accounts of the various companies were audited and approved quarterly by experts and accepted by the directors. Mr. Glidden thought it a fair statement to make that during the time he was treasurer of the various companies they paid at the rate of 15 per cent. a year on the capital invested or represented to be invested. During the month of June, 1882, the Suburban company may have shown net earnings at the rate of 21.53 per cent., or a total of $6,280 in dividends, but this represented nothing definite, as the next month the earnings might be shown to be a great deal less. More money happened to come in to the company at that time.

Mr. Glidden gave the following figures, showing the dividends paid by all but the Granite State of the companies forming the New England, for periods ranging upwards of a year, and all ending Oct. 1, 1883, the date of the consolidation: National Bell of Maine, including the Lowell, Worcester and Fitchburg districts, from May 1, 1879, paid in dividends $142,897.83, and the company had 4,017 subscribers and a large mileage of extra-territorial wires connecting cities in Maine at the time of consolidation. The Suburban company, from August, 1882, paid $33,250, and had 1,578 subscribers at consolidation. This company also had a lage revenue from communications from the suburban territory in Boston, which comprised nearly two-thirds of the number of connections made. The Bay State, from August, 1882, paid $49,000 in dividends and at consolidation had 2,888 subscribers. It did a large territorial business. The Boston & Northern, from May, 1882, paid $86,952 in dividends, and had 3,479 subscribers at consolidation. This company also had a large extra-territorial business. The total amount of dividends paid by these companies during the periods mentioned was $312,099.86.

Mr. Glidden did not think much money was paid by the companies with which he had been connected for rights of way. There was paid something for damages occasioned by acts of men employed by the companies in putting up wires, and for roof rents, the total amount thus paid being small. These privileges are valuable, but generally have not cost much. When Mr. Ingham said they did cost considerable money, he must have misunderstood the question as having reference to their value. The New England is yielding more now in gross receipts than the several companies forming the New England did when they were separate.

Mr. Glidden did not recollect any instance of dividends due Messrs. Vail and Madden not paid them direct. Mr. Lilley stated that his point in this testimony was to show that the American Bell company, through Messrs. Vail and Madden, had induced men and women to put money into various companies, dividends in which were not paid to them personally, as they did not wish to figure in connection with the companies. The people who put their money into the New England at $100 can now realize but $30, and their proposition is that the committee will be justified in reporting a bill to limit the Bell in its charges to licensees.

Mr. Bruce said it did not seem to him that Mr. Lilley would seriously ask, if any employé of the American Bell Telephone Company, without the knowledge of the company's president, had done something which ought not to be done, that the company ought to be punished for it. Mr. Lilley said he did not say "punished." Mr. Bruce, continuing, said that such a request would be about as absurd as to say that, because Charles Francis Adams, who happens to be a director in the Pacific Railroad, represented that the stock was a good investment, though it subsequently ruinously declined, the whole company should be punished for his statement, honestly made. Mr. Lilley contended that this was not a parallel case.

To Mr. Bent Mr. Glidden said the aggregate capital of the companies that went into the consolidation which formed the New England company was about $4,000,000. The dividends paid by those companies were fairly earned, and they had besides reserves in addition to the dividends made. The only dividend ever paid by the New England company was a quarterly one of 1½ per cent., Jan. 1, 1884. Mr. Glidden said he thought the directors of the New England capable men, and that they conducted the company's affairs honestly. The New England cannot pay dividends for several reasons: It is laying out money for reconstruction, for new construction, changing of system of accounts, increasing expense of executive management, none of which the old companies did. Reconstruction has been necessary to some extent. Mr. Glidden thought the life of a telephone plant, with ordinary repairs from time to time, is ten years at least. In answer to a question Mr. Glidden said that many of the stockholders in the old companies thought it would be better for them if the consolidation with the New England could be undone. The fault was not with the present managers, but with the present contract. A great many of the stockholders in the sub-companies, whom he represented, would like to have those companies as they were, with the same contracts they then had, as before consolidation, which is now believed to have been a sad mistake. Mr. Glidden said he honestly believed in consolidation when it was effected, but now he believed otherwise.

Mr. Bruce inquired, if the American Bell Company should restore the old companies to their original status, if it would be generous treatment.

Mr. Glidden thought it would be decidedly generous.

Mr. Bruce said the American Bell company thought as Mr. Glidden did, and if the consolidation could be undone, would be very glad to have the old companies go back under the original contracts.

Mr. Anderson said it was impossible to do that now, as the American Bell has put $1,000,000 into reconstruction of these companies.

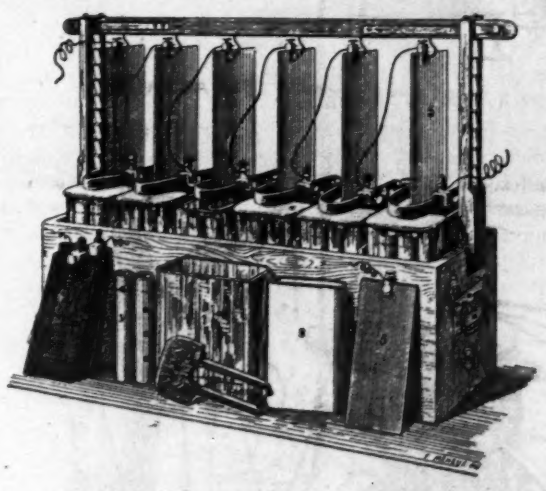
Mr. Loren N. Downs said the wires and poles will not wear out in five years, but the other apparatus will, and in the latter the changes carried out have not been made for improvements wholly. The old switch-boards would have lasted a year or two longer, only it was thought better to put in the improved ones. He thought it desirable to increase the number of subscribers in an exchange provided the company could get price enough for doing it. If there were 2,000 subscribers in Lowell, the company would do business in that city at a loss. Boston could take care of 4,000 subscribers without a loss. Mr. Downs though the dividends paid by the old companies fairly earned.

To Mr. Bent Mr. Downs said the life of a whole plant is four or five years. The old companies could not have paid as good dividends then if they had made provision by sinking funds for depreciation. The old companies also sold stock to carry on construction, and there was but little reconstruction. The New England company now pays for construction from its earnings and has much reconstruction. The expense of gaining a subscriber is now three or four times what it was in the old companies.

This closed the case for the petitioners.

The Chloris Baudet "Impolarizable Battery."

In our issue of April 18 we gave the results of the tests made on primary batteries exhibited at Philadelphia last year. The report also contains the results obtained with another battery, but which, for the reasons given below, were not incorporated with the others. This battery, which was exhibited by Messrs. Queen & Co., is called the Chloris Baudet, after the inventor; but for some reason it failed to reach the examiners at the time the other cells were examined, and not being disposed of, on account of its high cost, it was soon sent back to Paris. Still, in view of the claims made for this cell it was thought best to construct one and test it. The cut represents one of these batteries of six cells. It is called an unpolarizable battery, on account of its constancy of action. The following is a description of the cell by Baudet: The outer rectangular cell *I*, 22 cm. by 18 by 9. A porous cell 2, for the zinc plate 5. Two porous jars 3, one for crystals of bichromate of potash, the other for sulphuric acid; one with holes and the other without; two plates of carbon 4, each with suitable wire connections, and a suitable cover 6, for the whole, to maintain the points in their places. The solutions consist of a saturated solution of bichromate of potash, with sulphuric acid as for the ordinary bichromate battery for the outer jar containing the carbon, and a super-saturated solution of acid sulphate of potash $KHSO_4$ for the porous jar containing the zinc. The undissolved sulphate may remain in the bottom of this porous jar. Common salt may be used as a substitute for the potassium sulphate. In the cell constructed for the test, the bi-sulphate of potash was used in the porous jar. According to the report, when first set up this cell had an electromotive force of 1.87 volts. It was then put in short circuit with an external resistance of 5.8 ohms, including the galvanometer, when the deflection was 47°, with a current of .262 ampère. As the constant of the galvanometer was .245, it followed that the internal resistance of the cell was 1.3 ohms, which is a small resistance for a cell for constancy, but the immersed zinc was but about 3 inches of a half-inch rod. The needle fell one degree in the first five minutes, where it remained for an hour, when it rose to 47½°, where it stood steadily for five hours; the next morning it was 45°. It remained practically constant for about 28 hours, when it suddenly fell; evidently some of the material had been used up. This is a surprisingly good record for a cell, and surpasses the Grove, the Bunsen, or the common bichromate cells a long way.



THE "IMPOLARIZABLE BATTERY."

The Lay of the Telegraph Pole.

An opinion has lately been expressed by Mr. Cyrus W. Field and others—now entertained also by the Health Commissioners—that the digging up of the streets all over the city of New York in order to put the wires underground, as provided by the law passed in the New York Legislature last year, would help to bring disease into the city and invite an outbreak of cholera. The New York *World* seeks to make fun of the objection in the subjoined extraordinary production:

$ $
$ $ $
$ $ $ $
$ Bubble, $
$ Bubble, $
$ Toil and $
$ Trouble, $
—$ MUMPS, GOUT, MEASLES, COLLYWOBBLE, $—
$ Dropsy, $
$ Asthma, $
$ Croup, $
$ Catarrh, $
—$ PHTHISIS, CHILLS, MALARIA, $—
$ Apoplexy, $
$ Chicken-pox $
—AND PNEUMONIA—THAT'S WHAT KNOCKS.—
$ Rheumatism, $
$ This a treat is, $
—$ SO IS SPINAL MENINGITIS; $—
$ Heart disease, $
$ Hysteria, $
—$ AND THE BOSS—DIPHTHERIA. $—
$ Buy your pills $
$ For these ills, $
$ Call your doctor $
$ And your proctor, $
$ Crape and Coffin, $
$ Undertaker, $
$ Widow, orphan, $
$ Tombstone maker, $
$ Underground? $
$ I'll be bound, $
$ If you try it, $
$ You'll be found $
$ Where the bat $
$ And bugaboo, $
$ Mouse and rat $
$ Will gnaw at you! $
$ Leave me high $
$ In the air, $
$ And you're solid; $
$ But take care! $
$ I've a mission $
$ To fulfill— $
$ Ask the firemen $
$ That I kill! $
$ And the people $
$ Suffocating! $
$ I'm a dandy $
$ At cremating! $
$ Read reports $
$ of conflagration! $
$ My boss grip is $
$ Devastation! $
$ But see here! $
$ Lift your ear! $
$ I've been joking $
$ With you, dear! $
$ Would you now, $
$ If I squealed, $
$ Give me 'way $
$ To old man Field? $
$ No! Your hand! $
$ It's th' amount! $
$ It's a scheme $
$ Where dollars count! $
$ 'Twixt you, me and $
$ This here post, $
$ That's the dodge of $
$ That old ghost! $
$ Cheaper to buy up M. D.'s $
$ Than to plant us $
$ 'Neath the trees! $
$ You just wait $
$ Until he collars $
$ Th' Legislature $
$ With his dollars! $
$ Pardon me, for $
$ I must laugh! $
$ For I'm going $
$ To telegraph $
$ To *The World* $
$ And see him dusted $
$ Till his little $
$ Scheme is busted! $
$ Keep it dark! $
$ Close your mug! $
$ Guess I'll drop $
$ And Mash a plug! $

W. C. Q.

Telegraphic Physiology.

It is generally understood by physiologists, says Mr. W. Moon, in the English *Electrical Review*, that an ordinary tetanic muscular movement is essentially a vibratory movement, and that an apparently rigid muscle is really the subject of a series of vibrations corresponding to the series of nerve currents or "nerve pulsations from the brain." The number of these nerve currents in a second that will produce a tetanic contraction of the muscle is estimated at about 19 or 20.

From experiments made with induction currents upon muscles, it is estimated that if a single nervous impulse is given to a muscle, the muscle will be contracted and elongated in about one-tenth part of a second. This fact is somewhat interesting from a telegraphic point of view, since a telegraph clerk, when manipulating at about the average speed, forms his dots at about the rate of 10 to the second.

But a telegraphic clerk, when sending very rapidly, forms his dots at about the rate of between 14 and 15 to the second. Thus it appears that two sets of muscles, the one

depressing and the other raising the hand, can be alternately contracted by a series of nervous impulses; each series of nervous impulses having about three-fourths the rapidity that would be required to produce a tetanic contraction of the muscles.

In writing, the rapidity with which a muscle may repeat a motion in the same direction is possibly less than 10 times a second—thus, for instance, a pen could not make 10 down strokes in a second.

The less frequent contraction of the muscles in writing than in telegraphic manipulation is probably accountable by the greater complexity of the motion of the hand in writing than in telegraphic manipulation.

WESTERN NOTES.

THE ELECTRICAL WORLD BRANCH OFFICE,
CHICAGO, April 29, 1885.

Dickinson's immense bazaar, at St. Paul, Minn., is to be lighted by a 25-light Western electric machine.

The Thomson-Houston Electric Company have purchased the stock, circuit and franchise of the Jacksonville, Ill., Van Depoele Electric Light Company.

The Western Electric Company are getting out a new catalogue in three languages—English, French and German, for use at their Antwerp, Belgium, factory.

The Terre Haute Electric Light and Power Company have increased their plant by 25 lights, and as soon as the new machine is in place will be operating 75 lights in all.

A local company has been formed for the purpose of lighting the city of Pine Bluff, Arkansas, by electricity. The company starts off with a plant of 60 Van Depoele arc lights.

The Oshkosh *Times* is very enthusiastic over the Thomson-Houston electric light plant which was started up in that place, April 14. The plant consists of two dynamos of 25 lights each. A 75 horse-power Ball engine, furnished by Kingsland & Jackson, of Chicago, is used.

Otto Funk, the fellow who recently tried to steal all the books in the Chicago Public Library, has been arrested on suspicion of attempting to blow up the observatory of Chicago University. He claimed that he was only making some experiments for using electricity as a motive power.

It is said that the Indiana telephone law, which reduces rentals to three dollars a month, is to be contested by the Central Union Telephone Company, on the ground of unconstitutionality. Should the law stand it would close a large number of the telephone company's exchanges in Indiana. A similar bill is now before the Illinois Legislature.

I learn from the Indianapolis *Journal* that thirty-five passenger engines on the Vandalia main line are to be equipped at once with the American electric locomotive headlight. After a thorough test Col. Hill, general superintendent, and George Prescott, superintendent of motive power, have become fully convinced that this is the coming light for locomotive headlights. The Vandalia will be the first road in this country to adopt this light so generally.

Charles B. Schultz, employed by the Western Electric Company, was looking after the electric light lamps recently placed on Clark street by Willoughby, Hill & Co., in front of their store. He was mounted on a fourteen-foot ladder, with one hand on the lamp, arranging or replacing a carbon. The dynamo machine was in motion, and consequently the electric wires were charged. Unwittingly Schultz placed his foot on the iron column near which his ladder stood, thus completing a circuit and causing the electric current to pass through his body. Suddenly he was seen to withdraw his hand from the lamp, totter for a second on the ladder, and then fall backward on his head to the stone pavement beneath. When picked up he was found to be dead, and the body was taken to the morgue. The electric current was not strong enough to produce death, but his neck was broken by the fall and his skull crushed. The coroner's jury decided that Schultz came to his death from a multiple fracture of the skull resulting from a fall while unconscious from an electric shock.

The annual meeting of the stockholders of the American Electric Headlight Company was held at the Denison House, Indianapolis, April 21. Said one of the stockholders to a reporter: "We have had a long, hard pull to get this thing where we could feel satisfied with its operations. For more than two years we have had one of the greatest obstacles to contend with that have come before the electricians of this or any other country. To secure a lamp that would work perfectly on a locomotive, not to be affected by the oscillating and jarring of an engine running at the rate of fifty miles an hour, is a task that has been before the great electricians of all countries for thirty years. When our meeting was held here a year ago we expected to be ready for business before this time. Up to that time we had operated our light on seven different roads, and had never made a failure. The light had never gone out in a single instance; but we found the dynamo that we were then using was too heavy and occupied too much room, its weight being over 800 pounds. To bring this to the desired weight and compass has cost us ten months' work and over $30,000. Now we have passed the experimental stage and are ready to talk to our railroad friends. The plant we now use weighs about 400 pounds, and instead of running our engine 1,500 revolutions per minute, we have reduced the speed to 600. We thought a year ago we would not be able to sell a full equipment for less than $800; our price now is $450. We now have patents covering nearly 300 claims in the United States, and control patents in seven foreign countries. The lamp we are now using is the invention of George Pyle, and is the only lamp ever made that is electrically governed, all springs, weights, dash pots, etc., having been dispensed with."

I am in receipt of the Heisler Electric Light Company's new catalogue for 1885. This company have been in operation since 1882, with headquarters at St. Louis, Mo. The company own all the patents on electric lighting which have been granted to Mr. Charles Heisler, who was among the first inventors in this country to undertake the development and application of the electric light for practical illumination. The company's machines are specially intended to run arc and incandescent systems combined, and they manufacture complete systems of arc and incandescent lighting. They claim to have accomplished successful transmission over unusually great distances on a moderate sized wire from a central station. The company call attention to their entirely new principle, materially different from anything else in existence, and go on to say: "All other incandescent systems so far introduced are connected in multiple arc, because they cannot be connected in series, the lamp being of entirely too great a resistance, requiring the conductors of such enormous capacity or size as to make the system very expensive and absolutely impracticable. Our lamp having only the resistance of four ohms when hot, will only require four ampères and twenty volts per lamp yielding a light equal to thirty candles. Eight to ten such lights can be generated by one horse-power. The current for, say, sixty lights can be transmitted over a single circuit three or four miles on a No. 10 English gauge wire, having a resistance of three ohms per mile, with a total loss of current for one lamp to every four ohms resistance; that is, we can supply fifty-eight lamps distributed along the three miles, or all the lamps located at the furthest end of the three miles, making a loss of only two lamps. We have the only practical method for distance incandescent lighting, on wires only costing from $50 to $100 per mile on a single circuit, with lamps of thirty candle-power, or sixty candle-power on the same circuit." The Heisler company claim to have the only dynamo in existence admitting an actual subdivision of the current. Their 6-light machine may be arranged to run one arc and fifty incandescent, or, otherwise, five arc and ten incandescent lights, or any other combination. Neither of the currents has any connection with the other, and they are practically the same as though separate dynamos were employed. The company manufactures continuous as well as alternating current machines. A portion of the catalogue is devoted to the apparatus of the Heisler Electric Bell and Burglar Alarm Company and another portion to the American Carbon Company. The three companies are all under one management.

THE TELEGRAPH.

New Telegraph Line in California.—Senator Stanford is engineering a new Pacific Coast telegraph line in opposition to the Western Union.

Commercial Cable Land Lines.—A special land line of telegraph, built by the Commercial Cable Company, and extending from Havre to Paris, was opened on April 24. The Commercial Cable Company intends to make special efforts to establish close telegraphic communication between the leading stock exchanges of the world, including New York, London, Paris, Berlin, Vienna, and Amsterdam.

The "Magneta" Lost.—There is now little doubt that the steamer "Magneta," belonging to the Eastern Telegraph Company, which left London on March 8 for Malta with a large staff of telegraph officials on board, has gone down in the Bay of Biscay. The Cunard steamer "Palmyra" reported on her arrival at Genoa that when in the Bay of Biscay, 200 miles north of Finisterre, on March 24, she passed a lifeboat belonging to the "Magneta." The boat, which was in fairly good condition, contained mast and oars, but no sail. A further telegram relative to the boat picked up states: "No evidence of boat having been occupied. Oars did not appear to have been used. Part of mast lying across gunwale and about 18 inches of top plank knocked in. Otherwise in good condition and appeared to have been properly lowered."

Another Decision.—The California Supreme Court decides that "a telegraph company cannot legally stipulate against or limit its liability for mistakes happening in consequence of its own fault, such as a want of proper skill or ordinary care on the part of its operators, or the use of defective instruments. It is no defense for the company to say that the message was a cipher, and that the operator could not know what it meant. The operator may reject a message that is illegibly written; but if the words, whether in cipher or not, are plainly written, it is his duty to send the dispatch as written." The court holds that by simply showing that the errors were committed, the plaintiff makes out a *prima facie* case, and the company must then prove that the error was not due to the negligence of its operator, but to some cause beyond its control.

Telegraphy Without Wires.—Officers of the National Guard of Pennsylvania are just now devoting themselves to the interesting subject of telegraphing without wires, and they expect soon to send messages direct from the new City Hall in Philadelphia, or some other elevated point in the same city, to the lighthouse at Atlantic City, a distance of about 60 miles. They propose, for field practice, to teach the militia the use of the heliograph, which is now being used with great success in the Soudan for long-distance telegraphing. It may interest some of our readers to know that these instruments are nothing more than small mirrors for the reflection of light a great distance. The instrument itself consists of a mirror, four inches in diameter, mounted on a tripod, provided with suitable adjustments, so that the sun's light can be received upon it and reflected to a distant station. The mirror has an adjustment by which it can be made to follow the sun in its apparent motion. There is also a lever-key by which the signaler can deflect the mirror through a very small angle, either to the right or left, and these motions can be used to form an alphabet.

Jay Gould's Telegraphic Facilities.—The daily papers, which are always prying into somebody else's business, are now passing around the following account of Jay Gould's facilities for controlling the wires: Jay Gould has twenty-seven telegraph instruments in his office. Sitting at his desk, he can be put into communication with any place that is reached by a wire of the Western Union Telegraph Company. Therefore the managers of his properties are always accessible no matter where they may be. The message of congratulation which he sent to President Cleveland, when he conceded the latter's election, was transmitted from his office. The offices of twenty-five brokerage houses can be communicated with by wire, making it easy to give out orders to be executed in the market. Mr. Gould has but one telegraph instrument in his house. A telephone also runs between his office and residence. When Gould has any telegraphing to do at home, the operator goes to his residence. He has no "ticker" in his house, and when he stays away from his office, as he did much of the time last week, he has to get the quotations by telegraph, or run across the street to the Windsor Hotel for them.

A Notable Group of Men.—The death of General Anson Stager recalls to the telegraphic world, says the Chicago *Saturday Evening Herald*, the services of a small group of men during the war, in close proximity to President Lincoln and his Cabinet. These, in addition to Stager, were General Eckert, A. B. Chandler, C. H. Tinker and D. H. Bates. The three latter were the operators employed for the transmission of the most important messages dispatched during the nation's great struggle, and they all came out of the service with credit and renown. Mr. Chandler had subsequently in a special manner the confidence of General Eckert, and went with him into the Atlantic & Pacific Telegraph Company, of which he afterward became President. Mr. Bates also followed General Eckert into the American Union, but was absorbed into the Western Union subsequently, and is now at the head of the Baltimore & Ohio Telegraph Company, again in strong competition with his old friends, but whether to achieve a success yet remains to be determined. Mr. Tinker remains with the old company in an honorable and useful position. General Eckert, in conjunction with Dr. Norvin Green, controls the destinies of the Western Union, an organization more comprehensive and far-reaching than the world has ever before seen.

Spring Worries in Canada.—The difficulties of the various telegraph and telephone companies, recently, says the Montreal *Witness* of the 8th, have been very great. Mr. Angus Grant, Superintendent of the Montreal Division of the Great Northwestern Telegraph Company, says that the wires were interrupted by the recent storm, particularly between Montreal, Toronto, Ottawa and New York, causing the severest breaks of telegraphic communication, in the eastern division, in the history of the company. The sleet that fell froze the wires, making them so heavy that they gave way. Other interruptions were from trees, broken down with the weight of the frozen matter, falling across the poles, knocking them down. In one place eight consecutive poles had gone over within a distance of a quarter of a mile. Fifty men had been engaged between here and Toronto alone. The storm damage extended, so far as reports of damage went, between here and Napanee, and mostly in parts adjacent to the River St. Lawrence. There had been considerable delay in fixing the wires, owing to the trains being blocked, men not being able to get over the railway. "Sometimes as fast as they were put in working order at one point they would be reported down at another. It has not been as bad in my recollection, which extends back for twenty years. In the cities snow-slides from off houses gave us considerable trouble. Things are about fixed now, however."

THE TELEPHONE.

Electricity in War.—The Russian Government has ordered from a Paris balloon factory two elongated silk balloons, in order to experiment on their direction by electricity. The Italian Government has also ordered two silk balloons equipped with telephones, etc., for captive ascents.

Silent Telephones in Philadelphia.—Over 800 telephones operated by the Clay Commercial Company, in Philadelphia, are thrown out of service by the granting of a restraining order by the court, pending a final hearing, in June, of the Bell Company's suit for infringment of patent.

A Receiver Appointed.—Chief Justice Daly, of the Court of Common Pleas, has appointed H. H. Eldred receiver of the United States Telephone Manufacturing Company, in sequestration proceedings, based on a judgment for $2,855.21, obtained by James W. McDonough for money loaned. Execution was issued on the judgment and was returned unsatisfied. The corporation was crippled by its litigation with the Bell Telephone Company.

Explaining Induction.—The explanation given by the Brooklyn *Times*, it is thought, may have a more than local application: "The Eastern District Telephone wires have been working very badly for a few days back, but this morning the mystery was solved. A visit to the telephone exchange revealed the fact that the manager had hired an extraordinarily pretty girl to work one of the circuits, who was so deuced attractive that she caused an induction from the other wires to hers." Mr. Sargent might suggest this explanation to Mr. Lockwood for his next paper on the subject.

Upholding the Bell Patent in Austria.—The Imperial and Royal Ministry of Trade and the Royal Hungarian Ministry of Agriculture, Industry and Trade have decided on the petition of Otto Schaeffler, Mechanician of Vienna, bearing date Dec. 20, 1882, represented by Dr. Karl Bitter von Sääl, Court Advocate in Vienna, against Alexander Graham Bell, of Boston, represented by Dr. Victor Hasenhörl, Court Advocate in Vienna, for a partial annulment of the privilege granted to the said Alexander Graham

Bell, Dec. 16, 1877, with the priority of 1 P. M., Aug. 8, 1877, for 'improvements in electro-telephony," on account of want of novelty in the patent claims 11 to 16 inclusive. After hearing the defendant and obtaining the opinion of experts that the petition in so far as it is directed to a declaration of the nullity of the patent claims 13 and 15, in accordance with the enactments of section 291, *a*, *bb*, in connection with section 1 of the law of privilege of Aug. 15, 1852, is admitted, and the privilege in question as regards the claim 13, to wit; "In an electric telephone the combination of the plate with a magnet, with coils at its end or at its end near to the plate, essentially as described," and the claim 15, to wit: "In combination with an electric telephone, as described, the use of a speaking or hearing trumpet to conduct the sounds to or from the telephone, essentially as described," are declared null and void, on account of the want of novelty. On the other hand, in so far as the petition is directed to the annulment of the claims 11, 12, 14 and 16, it is rejected as unfounded, and the privilege attacked will herein be upheld.—Vienna, March 1, 1885.—*Amtsblatt zur Wiener Zeitung.*

THE ELECTRIC LIGHT.

Electric Railway Signals.—The Great Western Railway Company of England is utilizing the electric light very largely for the illumination of the signals on its lines.

The Belfast Lamp in France.—The well-known Paris firm of electrical engineers, MM. Sautter, Lemonnier et Cie., have purchased the patent rights for the manufacture and use of the Belfast arc lamp in France.

Poles in New York.—Under date of April 13, Commissioner Squire wrote to Corporation Counsel Lacombe, asking him whether or not electric lighting companies which might receive contracts for lighting the streets would have the right to place additional wires on poles already erected, or to erect additional poles to sustain wires in order to execute such contracts. On April 24 Mr. Lacombe replied that in his opinion such contracts would not carry with them exemption from the operation of the act of 1884, prohibiting the stringing of wires above ground in this city and Brooklyn after June 14 of that year, and requiring all wires to be removed from the surface of the streets before Nov. 1 next. This was the interpretation put upon the act, Mr. Lacombe says, by Judge Van Brunt, in the case of Clausen against the Baltimore & Ohio Railroad Company.

Electric Lighting for Picture Galleries.—A very interesting experiment was recently made at the Grosvenor Gallery, London, with the view of testing, by contrast, the two systems of gas and electric lighting. In the East Gallery the 400 gas burners there were lighted to their full power; in the West Gallery ten electric "Sun" lamps took the place of 800 gas jets. The result showed that, while in the one gallery the gas seemed to throw out a lurid, yellow light that imparted false shade and color to the surrounding pictures, the white, steady glow from the "Sun" lamps brought out the pictures in the other gallery in clear and correct definition, exactly as in ordinary daylight. The experiment, which was continued for two consecutive nights, was witnessed by a distinguished company, including Sir Frederick Leighton, Mr. Alma Tadema, and Sir Coutts Lindsay, and was pronounced by all to be a complete success as regards the superiority of the electric light. Mere effect, however, is not the only desirable feature possessed by electricity. The heat, smoke and other vapor from gas have a very deteriorating effect upon pictures—and, indeed, upon most works of art. No such results attend the electric light, which throws off little heat and neither smoke nor vapor, advantages the importance of which cannot be overrated. The Grosvenor Gallery will in future be lighted by these "Sun" lamps, which are the same as those in use for some time in the picture gallery and Jones collection at South Kensington Museum.

APPLICATIONS OF POWER.

Another English Electric Railway.—It is stated that there will shortly be completed for passenger conveyance a line of railway, at the Alexandra Palace, London, about a mile in length, leading from the gate of the palace grounds to the palace itself, by which visitors will avoid a tedious up-hill walk. The line will be worked by electricity.

San Francisco.—The proposed electric road to run from the Southern Pacific Depot to the Union Iron Works will have two rails, one positive and the other negative. When the cars are stopped for any reason, the engine which is coupled up with the dynamo at the generating station will stop automatically. The apparatus is in many respects novel.

Reckenzaun's Electrical Tramcars.—Messrs. G. A. Plewe & Co., of Berlin, have given Mr. Reckenzaun an order for one of his cars. The car is the first of a series to be placed on the roads. It is required for the opening of the Japanese Exhibition, and will convey passengers from the Spittel Markt, in the heart of the city, to Bauer's Ausstellung Park, about 4 kilometres, in the west end of Berlin.

Lifting by Electricity.—In the Baltimore Academy of Music, near the proscenium boxes on each side, two little flights of stairs lead down from the parquet to the orchestra. They are the favorite resting place for the dudes of Baltimore during performances. These dudes clog the way and ogle the chorus. The managers of the Academy found this a nuisance, and this week they connected the steel-covered stairs with a powerful electric battery behind the scenes. The other night twenty young men, attired in tight trousers, and with the hair on their twenty respective heads banged down almost to their eyebrows, sat joyously upon the steel rods snapping their forty eyes, of varied hue, upon the lasses of the Templeton Opera Company. Suddenly a mad cry arose from the throats of the gilded youths, and, as one man, they leaped upon their feet, each flapping his coat-tail with a motion of anguish. The battery had been turned on.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 56, a 57; Am. Dist. Tel., b 12, a 25; Postal stock, b 1¼; Postal sixes, b 12, a 15½; Western Union, b 58⅛, a 58⅜.

Telephone.—Am. Bell, b 204, a 205; Erie, b 21⅛; New England, b 28½, a 29; Mexican, b 1¼; Tropical, b 1¼.

It is stated that at the annual meeting of the New England company in New York, May 3, the odd or ninth director will be given to this company by the American Bell, which is at present in control. The Bell company has signified a willingness to make a concession in the royalty charged for instruments in outlying New England districts. Moreover, the executive committee of the New England company has voted to curtail the expenditures for reconstruction this year. It had been estimated that $170,000 would be required for construction and reconstruction during the calendar year. This will probably be reduced 40 to 50 per cent., and all these things, together with the increase of rentals, will make an important change in the company's finances—indeed, dividends will be brought nearer. The net earnings above construction in February are estimated at $12,000.

Electric Light.—Edison, b 50.

BUSINESS NOTICES.

Anti-Magnetic Shields for Watches.—These shields, made by Giles Brothers & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches which are already affected.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED APRIL 14, 1885.

Electric Arc Lamp; William F. Buckley, Cleveland, O..... 315,473
Consists in means whereby the carbon rod is continually forced down and prevented from vibrating when the lamp is jarred.

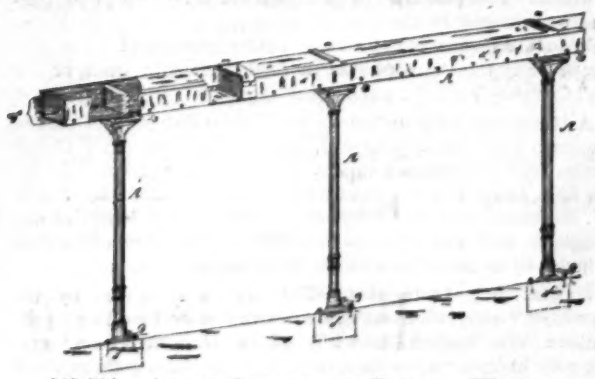
Circuit for Electrical Switch Signals; Alvah W. Hall, Meriden, Conn., Assignor to the Hall Railway Signal Co., of same place..... 315,498
Consists in combining with the switch rails and the signals and with the battery circuit several extra circuits.

Electric Lamp; Mirabeau N. Lynn, Rising Sun, Ind., Assignor to the Ohio Power and Light Co., Dayton, O..... 315,524
The two carbon holders are connected by a chain passed over pulleys, which are regulated by fluctuations of the current.

Aerial Conduit for Electric Wires; Donald B. Macquarrie, Kansas City, Mo..... 315,526
The posts have the flange *B* at the upper end, which projects sufficiently upon either side of the continuous chamber *A*. Upon this projection the cover *a* (when removed from its normal position) may be placed edgewise, which arrangement obviates the necessity of lowering it to the ground when the wires are being repaired. The said chamber is composed of the side sheets *K*, having the flanged bottom sheet *K'* riveted to the lower edge thereof.

Telegraphic Relay; Frederick Stitzel and Charles Weinedel, Louisville, Ky..... 315,566
The armature is adjusted by the weight *f*, so that the magnets *b* energized by a weak current will attract it, and the auxiliary weight *l* is adjusted by means of the nuts to allow the lever to lift or take up the weight after the armature has started for the energized electro-magnet and is near the maximum attractive force of the same. Upon breaking the current in the coil, the auxiliary weight will help the armature to recede from the magnets.

Voltaic Arc Lamp; Georges A. Tabourin, Marseilles, France..... 315,571
Consists of tubular carbon holders, with the regulating device



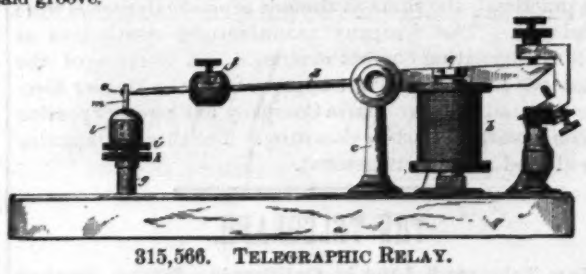
315,526. AERIAL CONDUIT FOR ELECTRIC WIRES.

located within the holder, said device being a coil spring in combination with a magnet.

Railway Connection; Henry D. Winton, Wellesley Hill, Mass..... 315,586
Consists in providing the rails with grooves near the ends, for holding spiral coils at the ends of the wires.

Multiple Switch-Board; Thomas J. Perrin, Brooklyn, N. Y., Assignor to Charles P. Huntington, Greenville, Miss..... 315,658
Consists in the combination, in a multiple switch-board, of a main line, its terminal on each of the boards, an electric coil at each of said terminals, a local circuit in which said coils are included, the annunciator and relay and electric circuits and connections.

Supporting Insulator for Telegraph Wire; Henry Prenzel, Philadelphia, Pa..... 315,660
A cap is screwed upon a piece containing a groove and wire in said groove.



315,566. TELEGRAPHIC RELAY.

Alarm for Railway Trains; Smith C. Pullman, Catskill, N. Y..... 315,662
Consists in peculiar construction of jack, in which two springs connected to the terminals respectively have a double curve.

Electric Coupling; Thomas T. Smith, Finsbury, London, England..... 315,673
Consists in combination with a perforated rose attached to the ceiling of a detachable carriage secured to the wires.

Electric Light Apparatus; Thomas T. Smith, Finsbury, London, England..... 315,674
Relates to hanging electric lamps supported by a flexible conductor containing both the flow and return wires suitably insulated; and it consists in the adaptation thereto of a spring reel or bobbin, on which the said cord may be wound up or from which it may be paid off, and the lamp be raised or lowered, as required, and fixed at the desired level.

Lightning Conductor; Francis R. Upton, Orange, N. J..... 315,679
Consists in a barb-wire conductor of peculiar construction—that is to say, a barb-wire having the barbs projecting therefrom all on one side of a plane through the axis of the wire.

Telegraphic Sounder; James F. Gilliland, Indianapolis, Ind..... 315,763
The armature-spring *D* is arranged to operate reversely to the magnets, and is adapted to be adjusted by means of the sliding nut *d* and the screw *D'*, whereby it is operated, said nut being mounted on a preferably hollow rod D^2, and said screw being journaled in a bearing at the outer end of said rod and entering said nut, a portion of which is preferably within said hollow rod. This forms a superior means of adjustment, as it is not liable to accidental variation, and by it the spring can be easily and quickly given the desired tension to properly act reversely to the magnetic force. The sounder-drum *E* is mounted on the post A^1, and is provided with sounding-points *e e'*, which extend inwardly from the two sides. These points are preferably in the form of adjusting-screws, and bear jam-nuts e^2, whereby they are adjusted and secured in any desired position.

Railway Signaling Apparatus; William Hadder, Brooklyn, N. Y..... 315,772
Consists in two oppositely arranged pairs of track circuit-closing instruments placed at the opposite ends of the track-section to be protected and in a polarized relay placed between the track instruments and capable of being operated thereby, the said relay controlling a local circuit in which is placed an electric gong or an electrically operated banner or colored light.

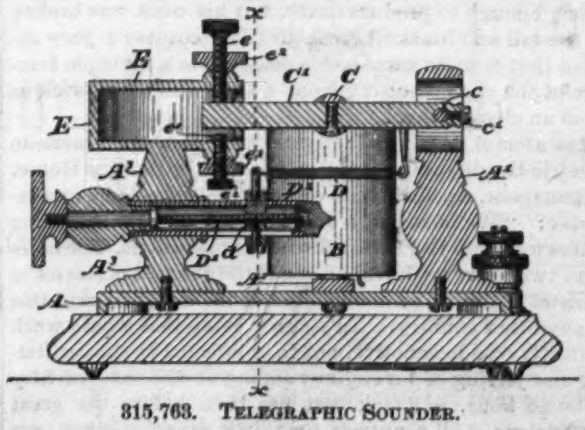
Electric Railroad Signal; Justin Hinds and Lorenzo L. Stimpson, Boston, Mass..... 315,785
Consists of the combination of the rack-bar driving a retarding mechanism, a sliding bar connected to levers arranged to be operated by a passing train, and having a bearing upon the rack-bar, and a weight for lifting the rack-bar after the sliding bar has been raised.

Telephone; William S. Voelker, Morton, Pa., Assignor to John H. Irwin, of same place..... 315,889
Consists of a fibrous magnetic cushion composed of magnetized metallic particles to support one of the electrodes of a telephone.

Armature for Dynamo-Electric Machines; William F. Buckley, Cleveland, O..... 315,903
The armature is made in the form of a broad flanged wheel, the flange being made of plates wound with coils of wire.

Electric Battery; Alfred Haid, Rahway, N. J., Assignor to the Excelsior Electric Apparatus Co., New York, N. Y..... 315,937 and 315,938
First. Consists of a rubber jar divided by transverse partitions into a number of cells in which the electrodes and exciting-liquids are placed. The negative electrode is made of a silver plate and bent so as to form a lining of the cell. The positive electrode is composed of a zinc plate that is retained at the lower part of the cell by a ring with radial arms, and that is attached to the jar by a hermetically closing screw-stopper. The positive electrode passes through the stopper, and is connected at its upper end electrically with a projecting portion of the negative electrode of the adjoining cell.
Second. Consists of the combination, with silver negative electrode in the form of linings for the cells and zinc positive electrodes, of an exciting-solution containing as a depolarizer bisulphate of mercury.

Automatic Call for Latent Signal Transmitters; F. Benedict Herzog, New York, N. Y..... 315,783 and 315,941
First. Consists in combining with the instrumentalities referred to in former patents, by same patentee, consisting of calling apparatus at the sending station, so organized and arranged with respect to the latent signal transmitter that the act of setting the latter to transmit its signal automatically operates the call, which informs the receiving station that the transmitter is set, ready to be released.
Second. Consists in arranging in the guest's room and in the



315,763. TELEGRAPHIC SOUNDER.

transmitter circuit an electric bell or call, so that it can be rung by the clerk from the office when specially desired, and at the same time in providing means by which this bell or call may readily be rendered operative or inoperative by the guest or any other person at pleasure, in case it is desired only to use it occasionally.

Underground Conduit; Albert E. Lytle, Chicago, Ill., Assignor of a part interest to Robert B. Smith, of same place..... 315,954
Consists of a supporting and insulating plate of glass or hard rubber having a soft rubber ring placed around its periphery between the disc and the side of the conduit, whereby the disc is held in proper position and not injured by the expansion and contraction of the conduit.